GEOTECHNICAL INVESTIGATION
SAN TOMAS AQUINO CREEK LEVEES
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

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Prepared For: Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, California 95118

Attention: Mr. Mohammad Khan

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January 20, 1999

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January 20, 1999
File: 12-3039-40

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, California 95118

ATTENTION: Mr. Mohammed Khan

SUBJECT: Geotechnical Investigation for the San Tomas Aquino Creek Levees, State Route 237 to Scott Boulevard, Santa Clara, California

Gentlemen:

We are pleased to submit our geotechnical investigation report for the subject project. The accompanying report provides the results of the field investigation, laboratory testing and engineering analyses. Conclusions and recommendations for the levees are also included.

The primary consideration for levee stability is the moderate to high potential for liquefaction of sand strata located beneath the levees at approximately Stations 86+25 and 162+47. The results of liquefaction will likely be settlement and possibly lateral movement of the levees. These conditions are discussed in the report.

If you have any questions regarding the information or recommendations presented in our report, please contact us at your convenience.

Sincerely,

KLEINFELDER, INC.

Scott M. Leck, G.E. 2067
Senior Geotechnical Engineer

Reviewed by

Chalerm "Beeson" Liang, G.E. 2031
Geotechnical Department Manager

cc: Addressee (6)

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GEOTECHNICAL INVESTIGATION
SAN TOMAS AQUINO CREEK LEVEES
SCOTT BOULEVARD TO STATE ROUTE 237
SANTA CLARA, CALIFORNIA

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SANTA CLARA, CALIFORNIA

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GEOTECHNICAL INVESTIGATION
SAN TOMAS AQUINO CREEK LEVEES
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

1. INTRODUCTION

This report presents the results of our geotechnical investigation for the San Tomas Aquino Creek levees between State Route 237 and Scott Boulevard in Santa Clara, California. The approximate location of the project site is shown on the Site Vicinity Map, Plate 1. This investigation has been performed for the Santa Clara Valley Water District (District) in general accordance with the Scope of Services presented in our proposal dated August 12, 1997 and the agreement between the District and Kleinfelder dated January 5, 1998.

This report includes our conclusions and recommendations related to the geotechnical aspects of the levee stability. Conclusions and recommendations presented in this report are based on the subsurface conditions encountered at the locations of our exploration and the provisions and requirements outlined in the Limitations section of this report. Recommendations presented herein should not be extrapolated to other areas or used for other projects without our prior review.

1.1 PROJECT DESCRIPTION

The project consists of a geotechnical evaluation of the existing levees on both sides of San Tomas Aquino Creek in Santa Clara, California. The project alignment stretches between approximately Station 25+00 at State Route 237 on the north and Station 175+00 near Scott Boulevard on the south. The levee alignments are shown on Plates 2 and 3.

1.2 PURPOSE AND SCOPE OF SERVICES

The purpose of our geotechnical investigation was to explore and evaluate subsurface conditions along the levee alignment in order to evaluate the conditions and stability of the levees against major earthquake and the 100-year flood in accordance with Federal Emergency Management

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Agency (FEMA) guidelines set forth in Section 65.10(b) Parts (3), (4), and (5) of the National Flood Insurance Program (NFIP)

The services performed for this investigation included a review of available geologic and geotechnical information in our office, site reconnaissance, directing the subsurface exploration program, reviewing laboratory testing performed by others, engineering analyses of field and laboratory data, and preparation of this report. The results of our engineering evaluation included the following items in the NFIP:

- Embankment Protection:
- Embankment and Foundation Stability;
- Liquefaction;
- Seepage; and
- Settlement.

Environmental services such as a chemical analysis of soil and groundwater were not included in our scope of services.

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2.0 GEOLOGY

2.1 GEOLOGIC SETTING

The San Francisco Bay Area lies within the Coast Range Geomorphic Province, a more or less discontinuous series of northwest trending mountain ranges, ridges, and intervening valleys characterized by complex folding and faulting.

Geologic and geomorphic structure within the San Francisco Bay area is controlled by the San Andreas fault (SAF). This right-lateral strike-slip fault which extends from the Gulf of California, in Mexico, to Cape Mendocino, off the coast of Humboldt County in northern California, forms a portion of the boundary between two independent tectonic plates on the surface of the earth. To the west of the SAF is the Pacific plate, which moves north relative to the North American plate, located east of the fault. In the San Francisco Bay area, movement across this plate boundary is concentrated on the SAF; however, it is also distributed, to a lesser extent across a number of other faults which include the Hayward and Calaveras, among others. Together, these faults are referred to as the SAF system. The northwest trend of the faults within the system are responsible for the strong northwest structural orientation of geologic and geomorphic features in the San Francisco Bay area.

Basement rock west of the SAF is generally granitic, while to the east it consists of a chaotic mixture of highly deformed marine sedimentary, submarine volcanic and metamorphic rocks of the Franciscan Complex. Overlying the basement rocks are marine and non-marine sedimentary rocks with some continental volcanic rock. These Tertiary rocks have typically been extensively folded and faulted largely as a result of movement along the SAF system which has been ongoing for about the last 25 million years. The inland valleys as well as San Francisco Bay are filled with unconsolidated to semi-consolidated deposits. Continental deposits (alluvium) consist of sand, silt, clay and gravel while the bay deposits typically consist of very soft organic rich mud (bay mud) or sand.

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2.2 AREA AND SITE GEOLOGY

The project site is located in the central portion of a broad alluvial basin known as the Santa Clara Valley. Materials underlying the site are mapped as medium grained alluvium and fine grained alluvium. These units are unconsolidated, moderately sorted, permeable fine sand, silt and clayey silt with a few lenses of coarse sand and unconsolidated, plastic, moderately to poorly sorted carbonaceous silt and clay. Our boring data indicates that the subsurface soils contain primarily silty clays with occasional lenses or channel deposits of fine to coarse grained sand most likely resulting from the wandering channel of San Tomas Aquino Creek.

2.3 FAULTING AND SEISMICITY

The closest active or potentially active fault is the southeast extension of the Hayward fault, located about 10 km northeast of the site. Other nearby faults include: the Monte Vista-Shannon fault, located approximately 12 km southwest of the site; the Hayward fault, located about 12 km northeast of the site; the Calaveras fault, located about 15 km northeast of the site; and the San Andreas fault, located about 17 km southwest of the site. A major seismic event on these faults could cause significant ground shaking at the site.

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3. SITE INVESTIGATION

3.1 SITE DESCRIPTION

The subject levees are located along both sides of San Tomas Creek, between State Route 237 (approx. Station 25+00) on the north and near Scott Boulevard (Station 175+00) on the south. We understand that improvements for this levee section were constructed in the late 1970's and consisted of clearing the original creek bottom of vegetation, excavation of the creek bottom, shaping channel sides by placing fill and/or cutting, raising the creek banks by placing compacted fill and installing gabions at selected areas to reduce erosion. Additional improvements including the raising of the levees between U.S. Route 101 and Scott Boulevard occurred in the early 1980's.

The current height of the levees above the adjacent creek bottom ranges from about 15 to 20 feet; creekside levee slopes range from about 1-1/2 to 1 to 2-1/2 to 1 (horizontal to vertical). On the landside, the levee heights range from about 5 feet to 10 feet above the adjacent ground surface. Side slopes are in the range of about 1-1/2 to 1 to 2-1/2 to 1. The tops of the levee ranged from about 12 to 15 feet wide. In general, the levee tops are covered with aggregate base rock and used as access roadways for levee and creek maintenance. At the time of our investigation, vegetation consisting of grasses, weeds, brush and small trees was present along the creekside face of the levees and within the channel.

In general, water flow through the creek during the dry time of the year (May through October) is minimal with flow depths on the order of 1 to 2 feet and flow velocities of about 1 foot per second (fps). Flow velocities for the 100-year event have been calculated by the District to be in the range of 3.0 to 7.4 fps for the existing vegetation conditions in the channel, and 3.6 to 8.5 fps for the condition where all of the vegetation is removed from the channel.

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2.2 FIELD INVESTIGATION

Our field investigation consisted of a surface reconnaissance and a subsurface exploration program which included 13 exploratory borings drilled by Spectrum Exploration, Inc., under the direction of our engineering staff. The borings were drilled between February 9 and 13, 1998, using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers to depths of about 40-1/2 feet below the existing ground surface. The materials encountered in the borings were visually classified in the field and a continuous log of each exploration boring was recorded by our engineering staff. Samples were obtained from the borings by driving a Modified California sampler up to a depth of 18 inches into the underlying soil using a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler was recorded for each 6-inch penetration interval. The number of blows required to drive the sampler the last 12 inches, or the interval achieved when higher resistance was encountered, is noted on the boring logs as blows per foot. Relatively undisturbed samples were also obtained using 2.75-inch inside diameter Shelby tubes which were pushed into the soil.

Visual classifications of the soils encountered in our exploratory borings were made in general accordance with the Unified Soil Classification System (ASTM D2487) by engineering staff from our firm. A key for the classification of the soil is presented in Appendix A on the Boring Log Legend, Plate A-1. The logs of the borings are presented on Plates A-2 through A-14 of Appendix A.

Logs of borings drilled for geotechnical studies along San Tomas Aquino Creek by others in 1977 and 1980 are included in Appendix D.

The locations of the borings are shown on Plates 2 and 3. The locations and elevations of the borings drilled for this study were surveyed by the Santa Clara Valley Water District following completion of the drilling.

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2.3 SUBSURFACE CONDITIONS

All of the borings were drilled through the existing levee sections, which varied in thickness from about 15 to 20 feet. At the levee surface, some of the borings encountered a layer of sand and gravel and/or aggregate base rock, varying from about 6 inches to about 2-1/2 feet thick. The levee materials consist of interbedded layers of clay, fat clay, gravelly clay, gravelly clay with sand, sandy clay, gravelly sand, silty sand, and clayey sand. The thickness of the fill varies from about 10 feet to 20 feet at the boring locations. In general, the clayey fill soils are in a stiff to hard state, and the granular fill soils are in a medium dense to dense. Laboratory compaction tests following the ASTM D1557-79 test procedure were performed on selected samples of the levee fill materials. Results of these tests indicate that the relative compaction of the levee fills are generally in the range of 85 to 98 percent.

Below the levee fill soils, the borings generally encountered clays and fat clays, with interbedded poorly graded sands and silty sands to the maximum explored depth of about 40-1/2 feet.

Groundwater was encountered between depths of about 15 and 30 feet below existing levee ground surface in our borings at the time of drilling. Groundwater levels will fluctuate depending on weather, rainfall, water level in the adjacent channel, and other factors not evident at the time of our investigation. It should be noted that the borings may not have been left open long enough for the groundwater level to stabilize.

The above is a general description of the subsurface conditions encountered at the site in the borings we drilled for this investigation. More detailed description of the soil conditions encountered is presented on the boring logs in Appendix A.

2.4 LABORATORY TESTING

Representative soil samples were obtained from the exploratory borings at selected depths. Samples were submitted to Harlan Tait Associates laboratory for soil testing. Laboratory testing of selected soil samples was conducted to evaluate the natural moisture content, in-place density,

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grain size analyses, Atterberg Limits, consolidation characteristics, compressive strength (unconfined, triaxial unconfined-undrained and consolidated-undrained with pore pressure measurements) and laboratory compaction (ASTM D-1557-79). The laboratory test results are presented on the boring logs at the approximate sample depth and in Appendix B. The Atterberg Limits test results are presented on Plates B-1 through B-3. The grain size analyses are presented on Plates B-4 through B-14. The Triaxial shear strength test results are presented on Plates B-15 through B-19. The consolidation test results are presented on Plates B-20 through B-23. A summary of the permeability test results is presented on Plate B-24. A summary of the unconfined compression and unconsolidated-undrained triaxial test results are presented on Plate B-25. A summary of the laboratory compaction test results is shown on Plate B-26.

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4. ENGINEERING ANALYSES

4.1 GENERAL

The following sections refer to the engineering analysis required in Section 65.10 of the NFIP and related requirements detailed in the U.S. Army Corps of Engineers (COE) Manual EM1110-2-1913 "Design and Construction of Levees", dated March 31, 1978.

4.2 EMBANKMENT PROTECTION

We understand that the existing channel was initially constructed by excavating up to several feet below original ground to form the channels and using the excavated soil as fill to construct the levees. In addition, borrow material from other sources was also used to construct the levees.. In general, the channels consist of clays and fat clays, while the levees are constructed of clays, fat clays, gravelly clays, clayey sand, clayey sand with gravel, with minor amounts of gravelly and silty sands. Through a majority of the year, water depths within the channel remain relatively shallow (1 to 2 feet) and constant with flow velocities of less than about 1 foot per second. During the 100 year flood stage event, the natural channel embankment and levees will contain 10 to 15 feet of water. With maximum estimated flow velocities in the range of 7.4 to 8.5 fps, it is possible that some erosion of levee materials could occur during high flow events. Based on the anticipated duration of the maximum velocity, it is our opinion that the existing vegetation should provide significant protection against erosion.

Given the moderate plasticity, the native and fill clays may exhibit moderate shrinking and swelling due to seasonal moisture fluctuations. Shrinkage cracks will likely develop within the levees during months of low precipitation. During and/or following rainfall, these cracks will become filled with water, leading to the development of hydrostatic pressures, softening of the surficial soils, and subsequent sloughing and erosion of the embankments. Accordingly, the levee embankments will need to be inspected and maintained periodically to prevent progressive sloughing and erosion.

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4.3 EMBANKMENT FILL COMPACTION

To evaluate the relative compaction of the levee fill materials, five bulk samples of the fill materials were tested to evaluate their maximum dry density and optimum moisture content as determined by ASTM Test D1557-91. The results of these tests are presented on Plate B-26. Based on the results of these tests and the dry density values for relatively undisturbed samples of the levee fill materials, relative compaction values have been estimated. Relative compaction is defined as the in-place dry density of the compacted soil divided by the laboratory compacted maximum dry density, expressed as a percentage. On this basis, the relative compaction values for samples tested range from the upper 80 percent range to the upper 90 percent range.

4.4 EMBANKMENT AND FOUNDATION STABILITY

Stability analyses were conducted on levee and embankment cross-sections in accordance with the guidelines outlined in the U.S. Army Corps of Engineer's Manual EM 1110-2-1913. The results of these analyses are included in Appendix C of this report, and are discussed in the following section.

Slope stability analyses were performed using the computer program UTEXAS3. Six levee cross-sections were selected by the Santa Clara Valley Water District for slope stability analyses to represent the range of conditions present along the levees which include existing slope geometry, field observations, boring logs and laboratory test results. The sections were analyzed for the conditions (Cases I to V) outlined in the U.S. Army Corps of Engineer's Manual EM 1110-2-1913. The critical conditions and the corresponding minimum strength and factors of safety requirements are presented in the following table.

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CASE NUMBER	DESIGN CONDITION	SLOPE ANALYZED	SHEAR STRENGTH	MINIMUM FACTOR OF SAFETY
I	End of Construction	Creekside and Landside	Q or S	1.3
II	Sudden Drawdown	Creekside	S where < R R where <S	1.0
III	Full Flood Stage	Creekside	S where < R (R+S)/2 where <S	1.4
IV	Steady Seepage from Full Flood Stage	Landside	S where < R (R+S)/2 where <S	1.4
V	Earthquake: Cases I, III and IV	Creekside and Landside	Seismic Coefficient = 0.2g	1.0

Strength parameters used in the analyses are presented on the following tables. These strength parameters were developed based on field Standard Penetration Tests, unconfined compressive strength tests and triaxial consolidated, undrained tests with pore pressure measurements. The actual strength parameters used were conservatively estimated from the test results, engineering judgement and published strength data.

The results of the slope stability analyses are presented in Plates 4 through 9. As the factors of safety indicate, the levees appear to be stable in the static condition for the cases reviewed, namely, end of construction, full flood stage, steady-state seepage and sudden drawdown. We anticipate that liquefaction could occur in the sand strata identified at Stations 86+25 and 162 +47. To estimate the residual shear strength of the liquified sand, we have used the relationship presented by Seed and Harder. Residual shear strengths used for the sand strata were 250 psf and 400 psf, respectively, for Stations 86+25 and 162 +47. Liquefaction will greatly reduce the strength of the sand strata, which will likely result in some lateral movement of the levee sections at those locations.

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Summary of Factors of Safety for Existing Levee Sections

	Static Cases				Seismic Cases		
Location	**Case I**	**Case II**	**Case III**	**Case IV**	**Case V**		
					Case I	**Case III**	**Case IV**
Sta 68+33							
Creekside	2.38	1.01	3.70	N/A	1.51	1.59	N/A
Landside	3.34	N/A	N/A	2.66	1.96	N/A	1.47
Sta 97+50							
Creekside	2.07	1.61	3.48	N/A	1.53	1.56	N/A
Landside	2.25	N/A	N/A	2.29	1.71	N/A	1.70
Sta 86+25							
Creekside	2.43	1.74	3.90	N/A	0.77	1.04	N/A
Landside	4.28	N/A	N/A	3.94	1.05	N/A	1.12
Sta 140+67							
Creekside	2.45	1.62	5.02	N/A	1.64	2.10	N/A
Landside	6.06	N/A	N/A	5.65	3.59	N/A	2.07
Sta 145+65							
Creekside	1.73	1.52	2.15	N/A	1.40	1.13	N/A
Landside	12.35	N/A	N/A	10.23	3.45	N/A	3.30
Sta 162+47							
Creekside	2.04	1.49	2.67	N/A	0.92	1.10	N/A
Landside	6.65	N/A	N/A	6.30	3.35	N/A	2.02

Case I - End of Construction

Case II - Sudden Drawdown

Case III - Full Flood State

Case IV - Steady Seepage from Full Flood Stage

Case V – Seismic for Cases I, III, and IV

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4.5 LIQUEFACTION ANALYSIS

Soil liquefaction is a phenomenon in which saturated, cohesionless soils lose their strength due to build-up of excess pore water pressure during cyclic loading such as that induced by earthquakes. The primary factors affecting the liquefaction potential of soil include: 1) intensity and duration of seismic shaking; 2) soil type and relative density; 3) existing overburden pressure; and 4) depth to groundwater. Soils most susceptible to liquefaction are generally clean, loose, fine-grained sands which are saturated and uniformly graded. Silty sands have also been known to be susceptible to liquefaction. The occurrence of liquefaction is generally limited to saturated (submerged) soils located within about 50 feet of the ground surface.

The subsurface soils encountered in our exploratory borings include medium dense sands below the groundwater level. Analysis of liquefaction potential of sand deposits was performed using the procedure developed by Seed and Idriss for a magnitude 7-1/2 earthquake on the nearby Hayward fault resulting in a peak ground surface acceleration of about 0.35g. Based on our analysis, some of the sand deposits located below the levees may experience liquefaction during strong earthquake shaking. The consequences of liquefaction, should it occur, are primarily settlement and lateral spreading if the sand strata are connected to a free surface (creek bank or creek bottom). In all cases, the sands are overlain by clay foundation soils and clayey levee embankment soils which will tend to serve as a "soil mat" and would reduce the potential impact of liquefaction on the existing levees. Locations where potentially liquefiable sands exist were identified at Borings B-1, B-7 and B-8. We have estimated the settlements which could result from liquefaction of these sand strata following the procedures proposed by Tokimatsu and Seed. Following this procedure, settlements of about one to two inches can be expected.

Locations where potentially liquefiable sands could result in lateral spreading were identified at Borings B-1, B-7 and B-8. At these locations, it is possible that the sand strata could daylight on the creek banks, although it is not present in the adjacent borings, indicating that it is likely not continuous with areal extent. However, at the location of Boring B-1, the sand strata could either daylight on the creek bottom or have only about 1 to 2 feet of cover. Liquefaction of this sand stratum could result in lateral flow into the creek channel. At the levee centerline, the levee and

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foundation include about 20 feet of relatively stiff clay soil. While it is difficult to estimate the resulting lateral and vertical movement of the levee as a result of the lateral spreading of the sand stratum, given the levee/landside geometry, it is difficult to foresee the circumstances which would result in the levee/creekbank moving downward more than three feet. It is therefore our opinion that the levee will remain intact and functioning even at the 100-year flood event.

At the locations of Borings B-7 and B-8, the subsurface conditions and geometry are similar to those at the location of Boring B-1, and the sand stratum could possibly daylight at the creek bottom. Because the sand stratum is about 11 feet thick, it is possible that significant vertical movements could occur as a result of lateral spreading. Estimation of exact magnitudes of lateral movement are very difficult, given the geometry of the levee/foundation soils. However, again because of the thickness of the levee section and foundation clay soil (about 20 feet) it is our opinion that the overall levee will remain intact, but will likely not maintain the full 3 feet of freeboard against the 100-year flood condition.

Data compiled by Youd and Hoose documented evidence of liquefaction in the site vicinity during the April 18, 1906 earthquake on the San Andreas fault. Evidence of liquefaction and lateral spreading was identified at Coyote Creek, located about 2 miles northeast of the northern section of the project. No evidence of liquefaction or related phenomena were documented at the subject site. Similarly, no evidence of liquefaction or lateral spreading was observed along the creek alignment as a result of the 1989 Loma Prieta earthquake.

4.6 SEEPAGE ANALYSIS

The maximum probable flood level for seepage analysis was taken to be approximately 3 feet below the top of the existing levees. Permeability testing of the levee soils indicate that it is in the range of 10^{-5} to 10^{-8} cm/sec. Because the duration of the probable maximum flood event is 3 to 4 days, we anticipate that seepage through the levees will be negligible, and that the levees are not anticipated to become saturated during these probable maximum flood events. However, to conservatively estimate levee behavior, we have estimated phreatic surfaces within the levees as shown on Plates 4 through 9 assuming fully saturated conditions for slope stability analyses.

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It is our opinion that seepage will not exist above the toe of the landside embankments. Accordingly, the potential for uncontrolled seepage or erosion emerging on the landside levee slope is judged to be low. These results appear to support observations of the Santa Clara Valley Water District personnel that the levees have historically have remained stable with no significant seepage observed during high water conditions.

4.7 SETTLEMENT ANALYSIS

Review of the consolidation test data on samples taken in the clay soils along the levee alignments indicates that the existing overburden pressures are at or below the estimated preconsolidation pressures. Based on the consolidation test results, we have estimated the time for 90 percent of primary consolidation for the clay strata below the levees to occur to be 15 to 25 years. Given that the levees have been in place for about 15 to 20 years, we do not anticipate additional significant consolidation settlement of the levee foundation soils. Similarly, elastic settlements of the levee materials and sandy levee foundation soils is judged be complete under the current levee configurations.

During improvements in 1995, levees were regraded and raised about one foot to provide at least three feet of freeboard above the 100-year flood elevation. Settlements resulting from this grading are estimated to have been relatively minor, and to have been completed at this time. Accordingly, we estimate the potential for future loss of freeboard as a result of settlement to be very low.

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5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Based on the information collected from this investigation, and from our geotechnical engineering analysis, we have formed the following conclusions regarding the stability of the subject levees. These opinions, conclusions and recommendations are based on our field and office studies, the properties of the soils encountered in our borings, and the results of the laboratory testing program.

5.2 EMBANKMENT PROTECTION

The moderate plasticity clays and clayey sands comprising the levees appear to be satisfactory to reduce the amount of erosion which could occur during low and high flow regimes. It is possible that some of the more granular materials might be erodable under higher flow velocities, which could result in erosion. It is our opinion that erosion, should it occur, will not be catastrophic, but will likely require repairs to maintain the overall stability of the levees.

Softening and subsequent sloughing and erosion of the embankments could occur as a result of shrinking and swelling of moderately plastic soils. Accordingly, the levee embankments will need to be inspected and maintained periodically to prevent progressive sloughing and erosion.

5.3 EMBANKMENT FILL COMPACTION

The relative compaction requirements for levee construction for the Santa Clara Valley Water District is a minimum of 90 percent. As discussed previously, the relative compaction values for samples tested range from the upper 80 percent range to the upper 90 percent range. This range in values is likely the result of variability of the fill materials within the levees ranging from clays to gravelly soils. Based on the strength test values and stability analyses, it is our opinion that the levees are stable under the analyzed loading conditions. Therefore, no reconstruction or recompaction of the levee materials is judged necessary.

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5.4 EMBANKMENT AND FOUNDATION STABILITY

It is our opinion that the embankments have gross stability under gravity loads against failures which could breech the levees and cause flooding during the 100 year flood level event.

At Stations 86+25 and 162+47, stability analyses indicate that factors of safety under seismic loading drop below 1.0 if liquifaction of the sands occur. The consequences of this instability during low water flows, which is the only case where the factors of safety are less than 1.0 are relatively minor; however, stabilization of the liquefied sand and repairs to sections of the levees will likely be required, if significant movement occurs. Based on our analysis, we conclude that the full 3 feet of levee freeboard will likely not be maintained following strong earthquake shaking and liquefaction along the levee alignment. Should earthquake loading occur during a 100-year flood level (a very low probability), a possibility exists that overtopping and flooding could result.

5.5 LIQUEFACTION

Along the majority of the levee alignments, sand strata present appear to be relatively thin and discontinuous. Liquefaction of these sands, should it occur, would result in about one to two inches) of settlement along the levee alignments, which should require no remedial work.

The risk of liquefaction is moderate to high in the loose to medium dense sands and silty sands which were identified at Stations 86+25 and 162+47. Liquefaction and lateral spreading of these sand strata is likely, which has the potential for causing permanent deformations of the levee sections. If deformations occur, remedial work will be required to restore the levee sections to their original condition.

5.6 SEEPAGE

As discussed previously, based on the permeability of the levee soils and the duration of the probable maximum flood event, 3 to 4 days, it is anticipated that seepage through the levees will be negligible, and the levees are not anticipated to become saturated during these probable

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maximum flood events. Accordingly, seepage, piping and erosion on the landside of the levees is judged to be very low.

5.7 SETTLEMENT

Elastic and consolidation settlements resulting from compression of levee and levee foundation soils is estimated to be nearly complete at this time. Therefore, the potential for loss of freeboard as a result of settlement is judged to be very low. As discussed above, the potential for liquefaction and resulting settlement is judged to be high, however, as it is estimated to be on the order of 1 to 2 inches, significant loss of the 3-foot freeboard is not anticipated.

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6. LIMITATIONS

The services provided under this contract as described in this report include professional opinions and conclusions based on the data collected. These services have been performed according to generally accepted geotechnical engineering practices that exist in the project area at the time the report was written. No warranty is expressed or implied.

This report may be used only by the Santa Clara Valley Water District, and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the Santa Clara Valley Water District, who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the clients or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

The conclusions and recommendations of this report are for the San Tomas Aquino Creek levees in Santa Clara, California, as described in the text of this report. The conclusions and recommendations in this report are invalid if:

- the report is used for adjacent or other property; or
- any other change is implemented which materially alters the levees from the time this report was prepared.

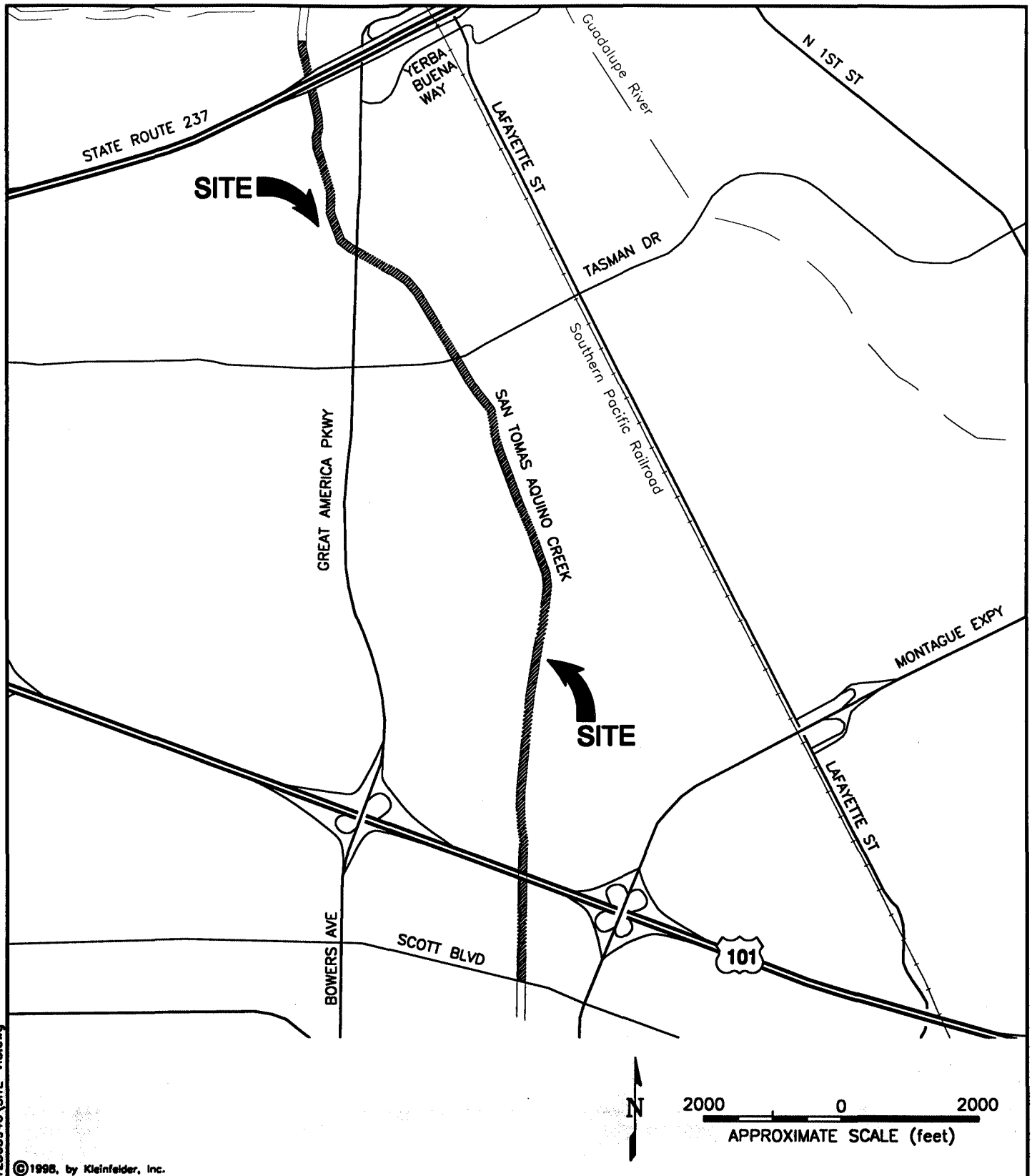
The conclusions and recommendations presented in this report are based on information obtained from the following:

- 13 borings made within the site;
- the observations of our engineer;
- the results of laboratory tests; and
- our experience on similar projects with similar soil conditions.

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The logs of the exploratory borings do not provide a warranty as to the conditions that may exist beneath the entire site. It is possible that variations in soil conditions and depth to groundwater could exist beyond the points of exploration that may require additional studies, consultation, and possible design revisions. If conditions are encountered in the field during the future which differ from those described in this report, our firm should be contacted immediately to provide any necessary revisions to these recommendations.

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CHECKED BY: S. Leck	DATE: 12-21-98

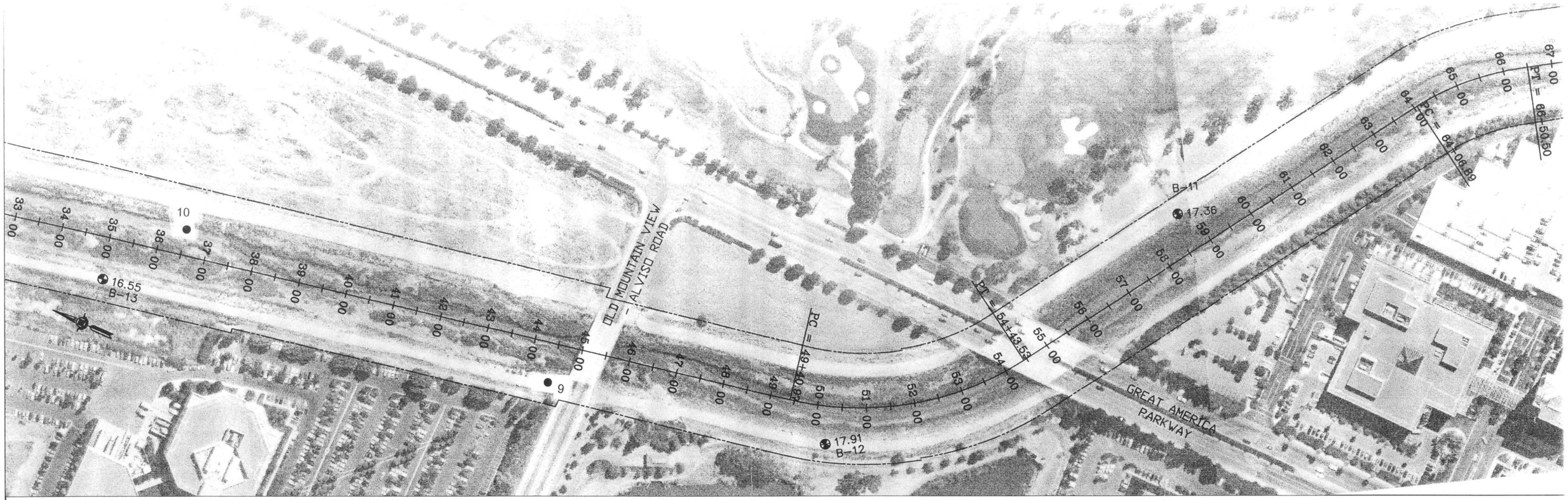
SITE VICINITY MAP

SAN TOMAS AQUINO CREEK
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

PROJECT NO. 12-303940

PLATE 1

CAD FILE: C:_KA-PROJ\SJ\12303940\SITE-VIC.dwg



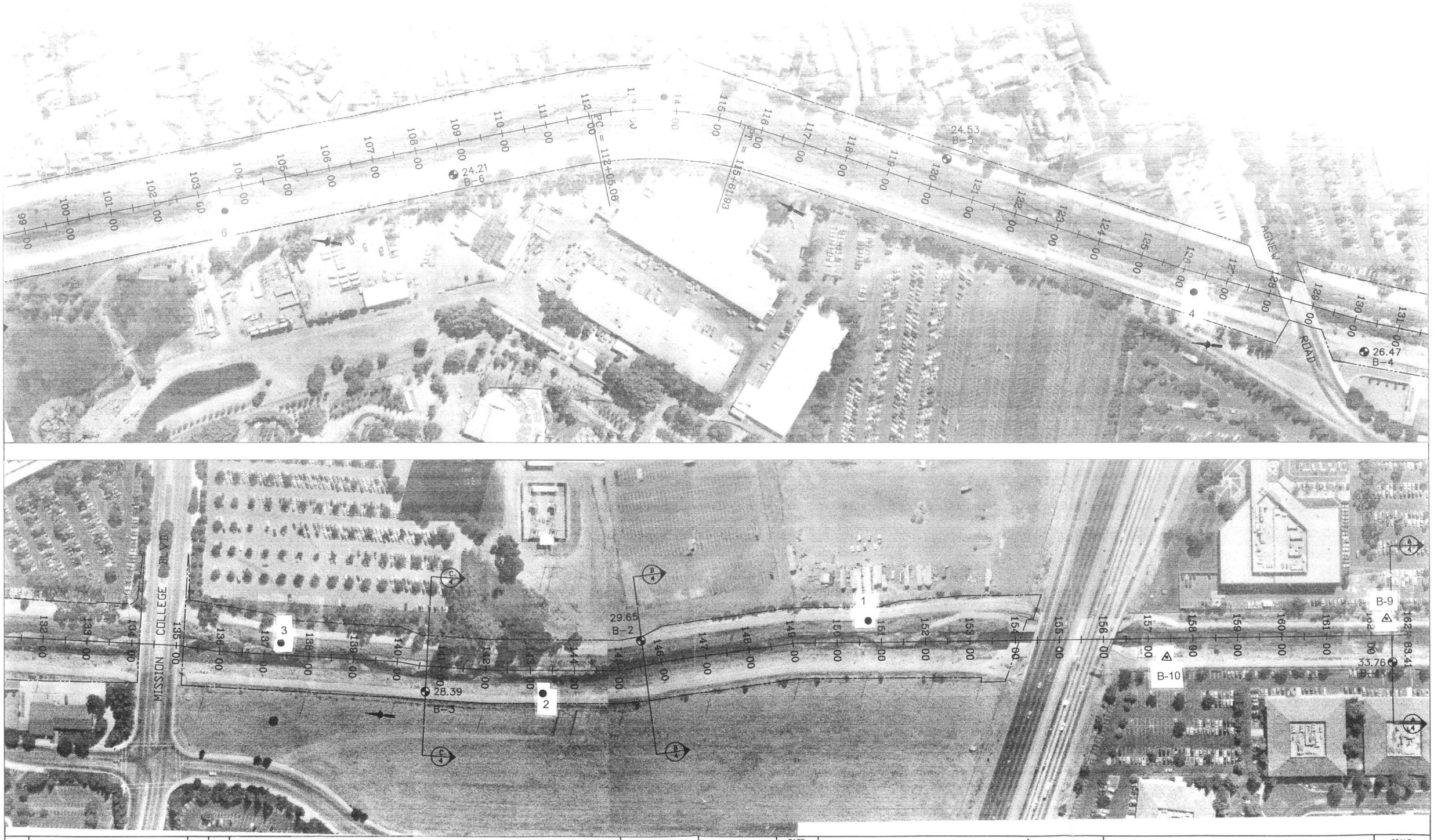
REV	DESCRIPTION	DATE	APPR

REFERENCE INFORMATION AND NOTES

- Boring Drilled for this Study
- Boring Drilled in 1978
- Boring Drilled in 1977

DATE 05-19-98	Santa Clara Valley Water District		SAN TOMAS AQUINO CK. BORING LOCATION PLAN
DESIGN			SCALE 1"=100'
DRAWN T.CALABRO	ENGINEERING CERTIFICATION	ENGINEERING APPROVAL	SHEET 2
CHECKED M. KHAN	PROJECT ENGINEER		

S:\SANTOMAS\FLD40\980429\PLAN1



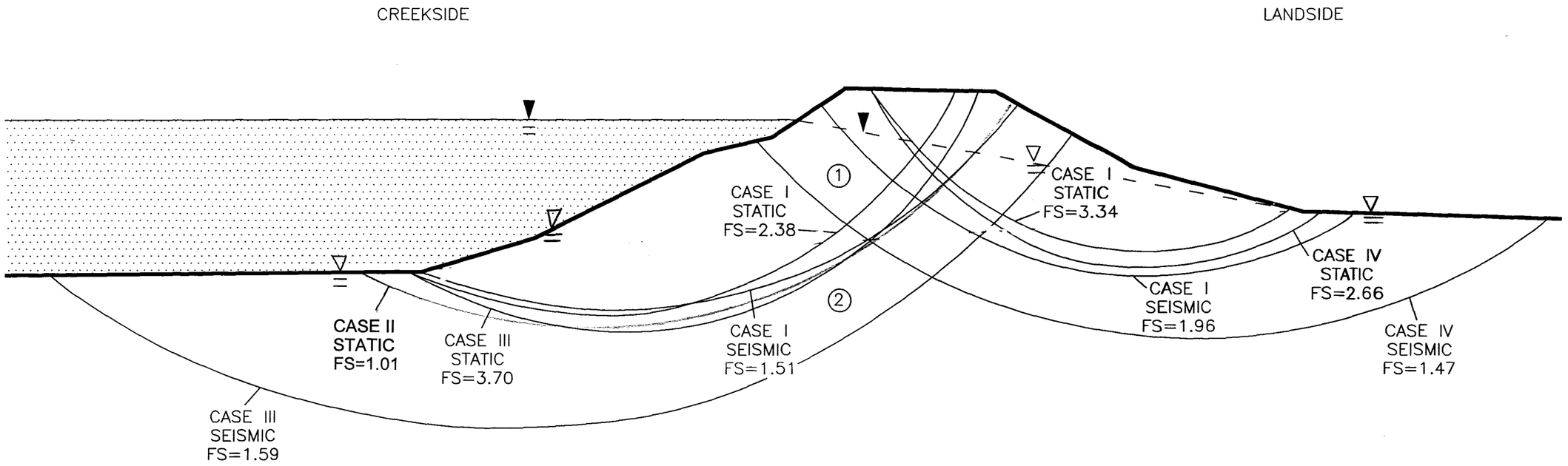
REV	DESCRIPTION	DATE	APPR

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DESIGN		SCALE 1"=100'
DRAWN T.CALABRO	ENGINEERING CERTIFICATION	ENGINEERING APPROVAL
CHECKED M. KHAN	PROJECT ENGINEER	SHEET 3

S:\SANTOMAS_EI_DIA\98042PS\PLAN1



Soil No	Description	Moist Unit Weight pcf	Shear Strength Parameters					
			R-Strength		S-Strength		(R+S)/2 - Strength	
			C, psf	ϕ, degrees	C, psf	ϕ, degrees	C, psf	ϕ, degrees
1	Levee Fill	130	400	18	100	25	250	23
2	Clay	120	500	20	0	35	250	29
3	Sand	120	0	32	0	32	0	32

▼ WATER LEVEL BEFORE DRAWDOWN

▽ WATER LEVEL AFTER DRAWDOWN

CASE I END OF CONSTRUCTION

CASE II SUDDEN DRAWDOWN

CASE III CRITICAL FLOOD STAGE

CASE IV STEADY STATE SEEPAGE AT FULL FLOOD STAGE

10 5 0 10

APPROXIMATE SCALE (feet)

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CROSS SECTION
STA 68+33

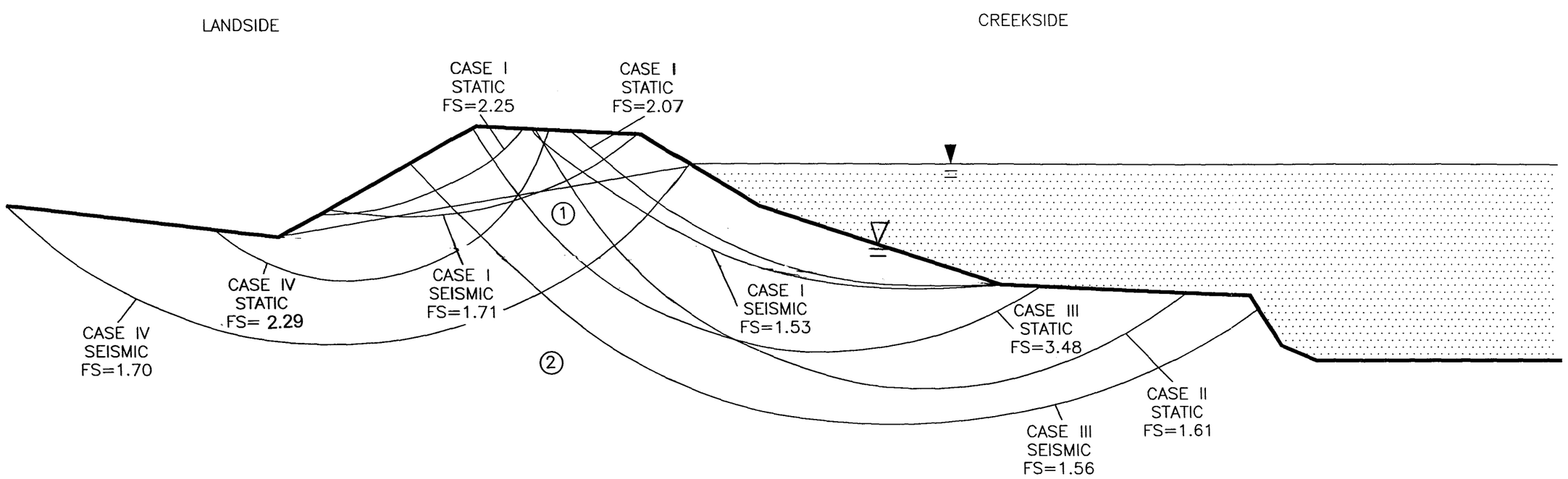
SAN TOMAS AQUINO CREEK
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

PROJECT NO. 12-303940

PLATE 4

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CAD FILE: C:_KA-PROJ\SJ\12303940.PLATE4dwg



Soil No	Description	Moist Unit Weight pcf	Shear Strength Parameters					
			R-Strength		S-Strength		(R+S)/2 - Strength	
			C, psf	ϕ, degrees	C, psf	ϕ, degrees	C, psf	ϕ, degrees
1	Levee Fill	130	400	18	100	25	250	23
2	Clay	120	750	8	0	35	375	22

▼ WATER LEVEL BEFORE DRAWDOWN

▽ WATER LEVEL AFTER DRAWDOWN

CASE I END OF CONSTRUCTION

CASE II SUDDEN DRAWDOWN

CASE III CRITICAL FLOOD STAGE

CASE IV STEADY STATE SEEPAGE AT FULL FLOOD STAGE

10 5 0 10

APPROXIMATE SCALE (feet)

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DRAFTED BY: L. Wahlgren DATE: 11-9-98

CHECKED BY: S. Leck DATE: 11-9-98

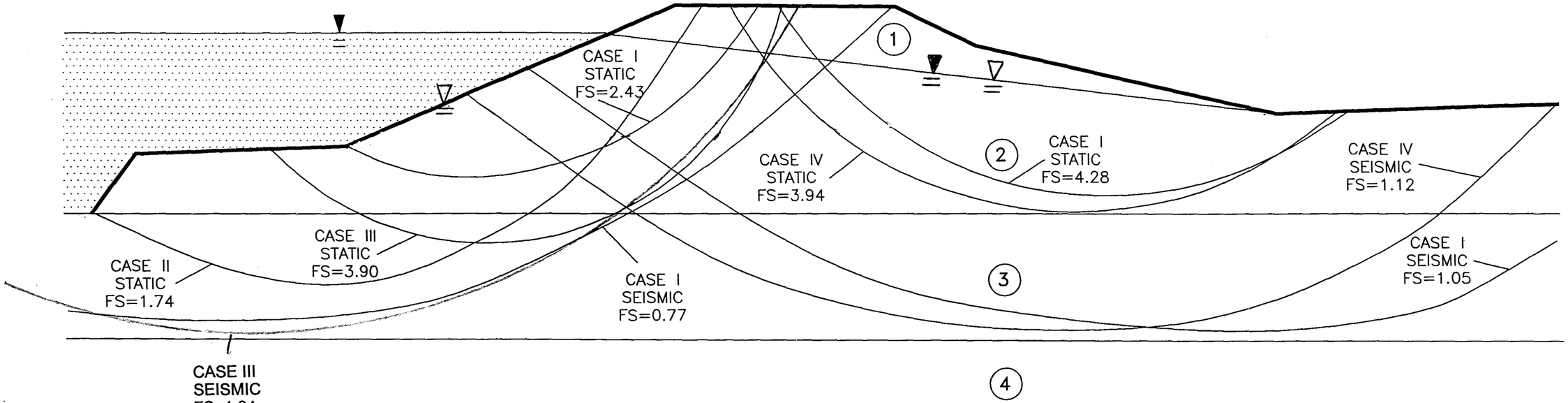
CROSS SECTION
STA 97+50

SAN TOMAS AQUINO CREEK
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

PROJECT NO. 12-303940

PLATE

5



Soil No	Description	Moist Unit Weight pcf	Shear Strength Parameters					
			R-Strength		S-Strength		(R+S)/2 - Strength	
			C, psf	ϕ, degrees	C, psf	ϕ, degrees	C, psf	ϕ, degrees
1	Levee Fill	130	400	18	100	24	250	21
2	Clay	120	500	20	0	35	250	29
3	Sand	120	0	30	0	30	0	30
4	Clay	120	500	20	0	35	250	29

▼ WATER LEVEL BEFORE DRAWDOWN

▽ WATER LEVEL AFTER DRAWDOWN

CASE I END OF CONSTRUCTION

CASE II SUDDEN DRAWDOWN

CASE III CRITICAL FLOOD STAGE

CASE IV STEADY STATE SEEPAGE AT FULL FLOOD STAGE

10 5 0 10

APPROXIMATE SCALE (feet)

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CAD FILE: C:_KA-PROJ\SJ\12303940.PLATE6dwg

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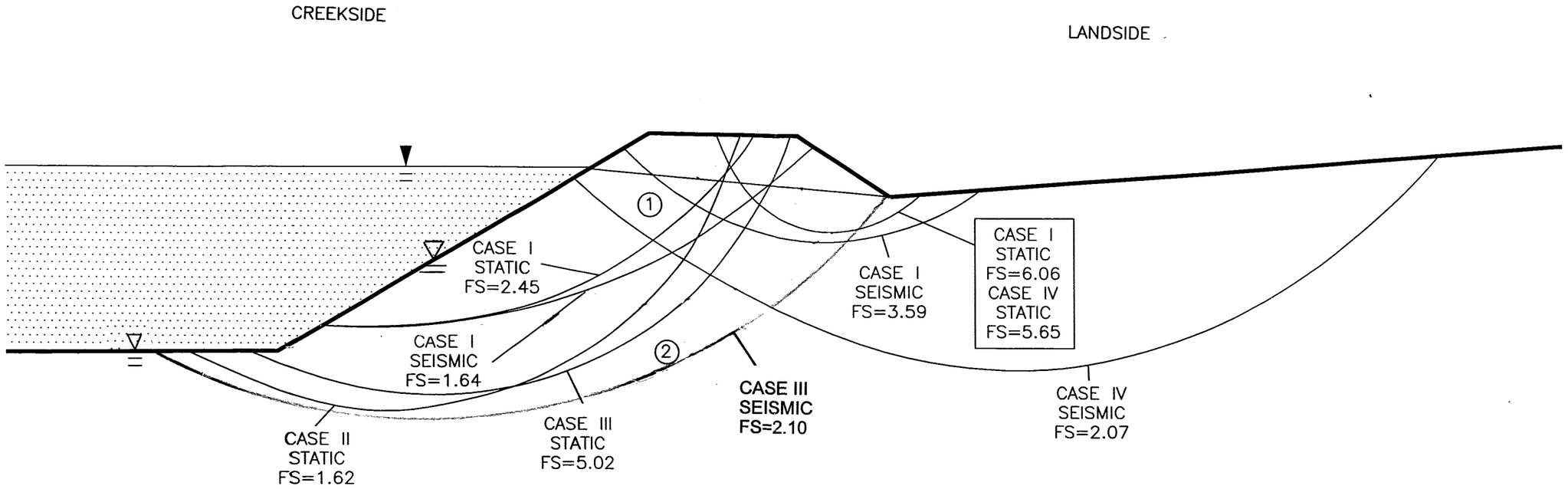
CHECKED BY: S. Leck DATE: 11-9-98

CROSS SECTION STA 86+25

SAN TOMAS AQUINO CREEK
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

PROJECT NO. 12-303940

PLATE 6



Soil No	Description	Moist Unit Weight pcf	Shear Strength Parameters					
			R-Strength		S-Strength		(R+S)/2 - Strength	
			C, psf	ϕ, degrees	C, psf	ϕ, degrees	C, psf	ϕ, degrees
1	Levee Fill	130	400	18	100	24	250	21
2	Clay	120	500	20	0	38	250	29

▼ WATER LEVEL BEFORE DRAWDOWN

▽ WATER LEVEL AFTER DRAWDOWN

CASE I END OF CONSTRUCTION

CASE II SUDDEN DRAWDOWN

CASE III CRITICAL FLOOD STAGE

CASE IV STEADY STATE SEEPAGE AT FULL FLOOD STAGE

10 5 0 10

APPROXIMATE SCALE (feet)

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CAD FILE: C:_KA-PROJ\SJ\12303940.PLATE7dwg

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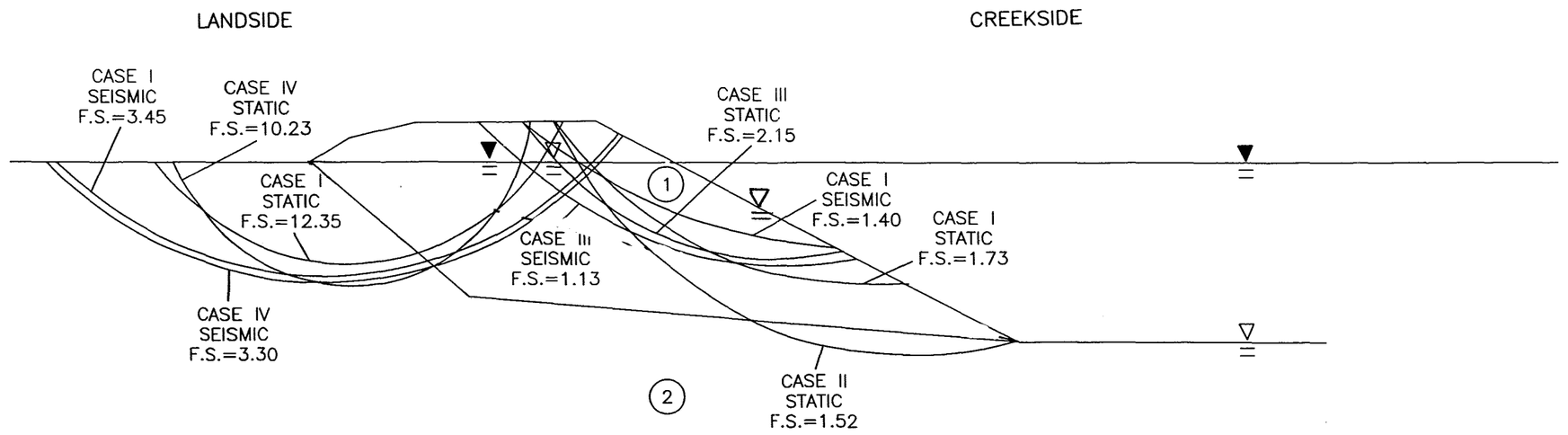
CHECKED BY: S. Leck DATE: 11-9-98

CROSS SECTION STA 140+67

SAN TOMAS AQUINO CREEK
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

PROJECT NO. 12-303940

PLATE 7



Soil No	Description	Moist Unit Weight pcf	Shear Strength Parameters					
			R-Strength		S-Strength		(R+S)/2 - Strength	
			C, psf	ϕ, degrees	C, psf	ϕ, degrees	C, psf	ϕ, degrees
1	Levee Fill	130	400	18	100	24	250	21
2	Clay	120	500	20	0	35	250	29

▼ WATER LEVEL BEFORE DRAWDOWN

▽ WATER LEVEL AFTER DRAWDOWN

CASE I END OF CONSTRUCTION

CASE II SUDDEN DRAWDOWN

CASE III CRITICAL FLOOD STAGE

CASE IV STEADY STATE SEEPAGE AT FULL FLOOD STAGE

10 0 10

APPROXIMATE SCALE (feet)

KLEINFELDER

CROSS SECTION
STA 145+65

SAN TOMAS AQUINO CREEK
SCOTT BOULEVARD TO STATE ROUTE 237
SANTA CLARA, CALIFORNIA

DRAFTED BY: L. Wahlgren DATE: 11-9-98

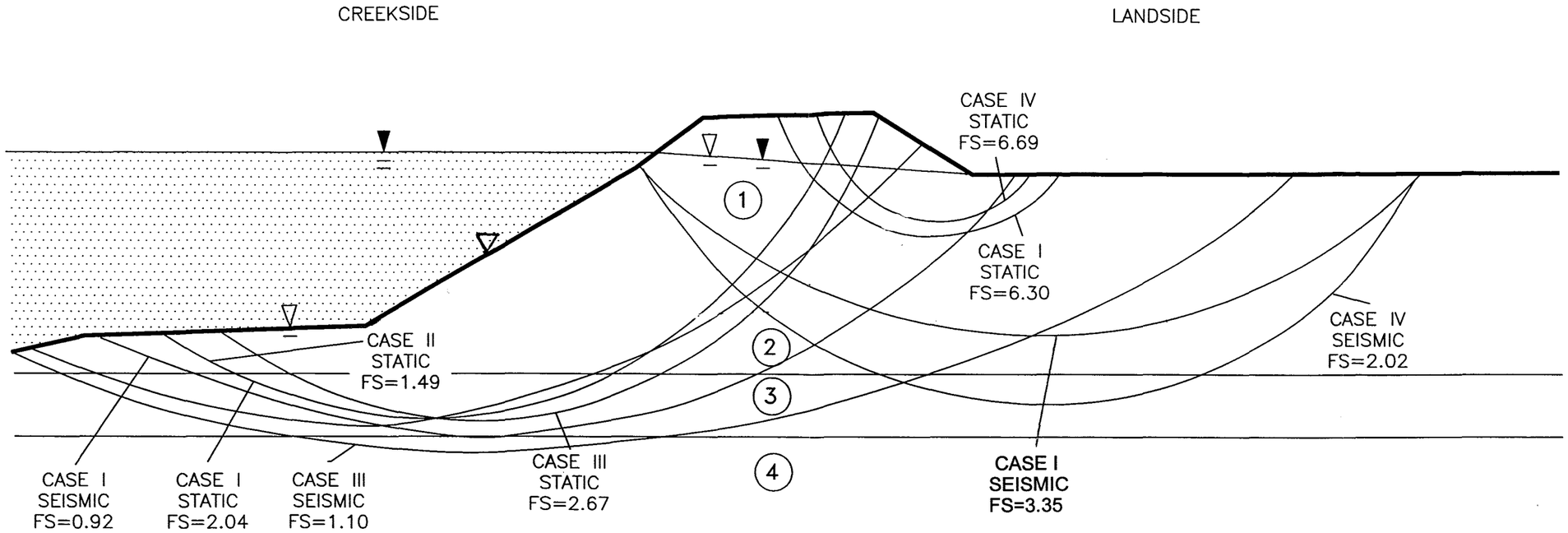
CHECKED BY: S. Leck DATE: 11-9-98

PROJECT NO. 12-3039-40

PLATE **8**

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CAD FILE: C:_KA-PROJ\SJ\12303940\PLATE8.dwg



Soil No	Description	Moist Unit Weight pcf	Shear Strength Parameters					
			R-Strength		S-Strength		(R+S)/2 - Strength	
			C, psf	ϕ, degrees	C, psf	ϕ, degrees	C, psf	ϕ, degrees
1	Levee Fill	130	400	18	100	24	250	21
2	Clay	120	500	20	0	35	250	29
3	Sand	120	0	30	0	30	0	30
4	Clay	120	500	20	0	35	250	29

▼ WATER LEVEL BEFORE DRAWDOWN

▽ WATER LEVEL AFTER DRAWDOWN

CASE I END OF CONSTRUCTION

CASE II SUDDEN DRAWDOWN

CASE III CRITICAL FLOOD STAGE

CASE IV STEADY STATE SEEPAGE AT FULL FLOOD STAGE

10 5 0 10
APPROXIMATE SCALE (feet)

KLEINFELDER

DRAFTED BY: L. Wahlgren DATE: 11-9-98

CHECKED BY: S. Leck DATE: 11-9-98

CROSS SECTION
STA 162+47

SAN TOMAS AQUINO CREEK
STATE ROUTE 237 TO SCOTT BOULEVARD
SANTA CLARA, CALIFORNIA

PROJECT NO. 12-303940

PLATE

9

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CAD FILE: C:_KA-PROJ\SJ\12303940.PLATE9dwg

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		LTR	ID	DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		Well-graded gravels or gravel sand mixtures, little or no fines.
		GP		Poorly-graded gravels or gravel sand mixture, little or no fines.
		GM		Silty gravels, gravel-sand-silt mixtures.
		GC		Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW		Well-graded sands or gravelly sands, little or no fines.
		SP		Poorly-graded sands or gravelly sands, little or no fines.
		SM		Silty sands, sand, and silt mixtures.
		SC		Clayey sands, and clay mixtures.

MAJOR DIVISIONS		LTR	ID	DESCRIPTION
FINE GRAINED SOILS	SILTS AND CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL		Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts.
		CH		Inorganic clays of high plasticity, fat clays.
		OH		Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils.



Standard Penetration Split Spoon Sample 51 mm (2.0 inch) O.D., 35 mm (1.4 inch) I.D.

Modified California Sampler 64 mm (2.5 inch) O.D., 51 mm (2.0 inch) I.D.

Bulk Sample

No Recovery



Approximate water level first observed in boring



Approximate water level observed in boring following drilling

PEN = Pocket penetrometer reading, in MPa
TV:Su = Torvane shear strength, in MPa
DS = Direct Shear
OVM = Organic Vapor Meter
TXUU = Shear strength at failure with corresponding strain

NOTES: Blow counts represent the number of blows of a 623 N (140-pound) hammer falling 0.76 m (30 inches) required to drive a sampler through the last 0.31 m (12 inches) of an 0.46 m (18-inch) penetration, unless otherwise noted.

The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

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PROJECT NO. 12-3039-40

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California
BORING LOG LEGEND

PLATE

A-1

Date Completed: 2/9/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 34 feet (MSL)
		8	107	18				**(FILL) CLAY (CL)** - brown, moist, very stiff, some coarse sand and fine gravel
		23	112	16		LL=37, PI=21	>4.5	-olive
5		36	116	13			>4.5	
		19	104	20			>4.5	
								(FILL) FAT CLAY (CH) - dark gray, moist, very stiff
10		23	104	19			>4.5	-olive-brown
		18	103	22			>4.5	-yellow-brown
15		8	102	22			2.0	**CLAY (CL)** - mottled olive-brown, moist, stiff
		7						
20		8						**SILTY SAND (SM)** - mottled olive-brown, wet, loose
25		7					1.5	**SANDY CLAY (CL)** - gray, moist, stiff
30		10					2.0	
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-1

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-2

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		25				-#200=9%		**POORLY GRADED SAND WITH CLAY (SP-SC)** - gray, wet, medium dense, fine to coarse grained, trace fine gravel
40		31				-#200=5%		-less fines
								Bottom of Boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-1

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-2
(cont'd)

Date Completed: 2/10/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 30 feet (MSL)
		13	106	17			>4.5	**(FILL) BASEROCK** - brown, moist, gravelly sand, well graded
		20	124	9			>4.5	**(FILL) CLAY (CL)** - olive, moist, very stiff
5		10					2.5	**(FILL) GRAVELLY CLAY (CL)** - olive, moist, very stiff, fine grained gravel -stiff
		11				LL=48, PI=29	2.5	**(FILL) CLAY (CL-CH)** - dark gray, moist, stiff
10		5	91	26			2.5	
		17	91	24			2.0	-olive-brown, trace of coarse gravel -red-yellow
15		15	101	24			2.0	
		10	94	29			1.5	**CLAY (CL)** - mottled yellow-brown,moist, stiff
		10	102	24			1.0	-mottled olive, stiff
20		9					0.5	-medium stiff
25		17					1.5	-olive-gray, stiff
30		27					>4.5	-olive-gray, very stiff
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-2

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-3

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
	■	22					1.5	-olive, stiff
								SILTY SAND (SM) - gray, wet, medium dense, medium sand
40	■	27					1.0	**CLAY (CL)** - mottled gray, moist, medium stiff
								Bottom of boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-2

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-3
(cont'd)

Date Completed: 2/9/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 28 feet (MSL)
								(FILL) BASEROCK
								(FILL) CLAY (CL) - brown, moist, very stiff
		21					>4.5	**(FILL) GRAVELLY CLAY (CL)** - olive-brown, moist, fine gravel
		23	125	11		LL=41, PI=24	>4.5	**(FILL) CLAY (CL)** - brown, moist, very stiff, trace of coarse gravel
5		15	118	11		-#200=39%		**(FILL) CLAYEY SAND (SC)** - olive-gray, moist, very dense, medium to coarse grained, some fine gravel
		15	124	9		LL=38, PI=20	3.0	**(FILL) CLAY (CL)** - olive-brown, moist, very stiff, some fine sand
10		14	95	26			3.0	
		11	101	23			1.5	**(FILL) SANDY CLAY (CL)** - light brown, moist, stiff
15		7	107 ▼	20			2.0	**(FILL) CLAY (CL)** - yellow-brown, moist, stiff
							1.5	**CLAY (CL)** - mottled olive brown, moist, stiff
20		12				LL=56, PI=35	1.5	**FAT CLAY (CH)** - olive-gray, moist, stiff
								-gray
25		9	101	25			1.0	-stiff
30		21					3.0	-olive, very stiff
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-3

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-4

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		14						**SANDY SILT (ML)** - olive, moist, medium dense, fine to medium sand
40								-wet
		47						**SILTY SAND (SM)** - olive, wet, dense, fine to medium sand
								Bottom of boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-3

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-4
(cont'd)

Date Completed: 2/10/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 26 feet (MSL)
		17						**(FILL) BASEROCK** - moist, well graded gravelly sand, maximum grain size 3/4 inch
		20					>4.5	**(FILL) GRAVELLY CLAY (CL)** - brown, moist, fine grained gravel
5		22				-#200=41%		**(FILL) CLAYEY SAND WITH GRAVEL (SC)** - gray, moist, medium dense, fine to coarse grained, fine gravel
		30				LL=37, PI=20		
		11	94	26			2.0	**(FILL) CLAY (CL)** - brown, moist, stiff
10		16					4.0	**(FILL) CLAY (CL)** - dark brown, moist, hard
		18					2.5	-gray-brown, stiff
15		17					2.5	**CLAY (CL)** - mottled olive-brown, moist, stiff
		9					1.5	
								-olive-brown
20							2.0	
25		10					0.5	-gray-brown, soft to medium stiff
								SANDY SILT/SILTY CLAY (ML-CL) - gray-brown, moist, soft to medium stiff
30		8					0.5	-gray
								POORLY GRADED SAND WITH SILT (SP-SM) - gray, moist, medium dense
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-4

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-5

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
						-#200=13%		**CLAYEY SAND WITH GRAVEL (SC)** - gray, moist to wet, fine to coarse sand
40		25				-#200=7%		**POORLY GRADED SAND WITH CLAY (SP-SC)** - gray, moist to wet, medium dense, fine to coarse sand
								Bottom of Boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-4

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-5
(cont'd)

Date Completed: 2/10/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 25 feet (MSL)
		15						**(FILL) CLAYEY SAND (SC)** - brown, moist, fine sand with a trace of coarse gravel
		25						**(FILL) SANDY CLAY (CL)** - olive, moist, very stiff, with some fine gravel
5		34				-#200=37%		**(FILL) CLAYEY SAND WITH GRAVEL (SC)** - olive-gray, moist, dense, fine to coarse sand and gravel
		29				-#200=34%		
		18	98	14			>4.5	**(FILL) CLAY (CL)** - brown, moist, hard
10		10					4.5	**(FILL) SILTY SAND (SM)** - brown, moist, loose to medium dense
						-#200=34%		
		11	109	20			2.0	**(FILL) CLAY (CL)** - brown, moist, stiff
15		10	105 ▼	20			3.0	-yellow-brown
		12	104	23			2.5	-mottled yellow-brown
								CLAY (CL) - olive, moist, stiff
20								-medium stiff
							2.0 2.0	
25		8	93	30			<.5	-olive, soft
30		20	108	20			1.0	-gray, medium stiff to stiff
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-5

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-6

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
	■	10					1.0	-mottled gray
40	■	14					1.0	
								Bottom of Boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-5

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-6
(cont'd)

Date Completed: 2/11/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 24 feet (MSL)
		13						**(FILL) BASEROCK** brown, moist, fine to coarse sand and gravel
		14	113	13			1.8	**(FILL) SANDY CLAY (CL)** brown, moist, fine to coarse sand with fine gravel
5		10	122	10			3.0	**(FILL) CLAY (CL)** - brown, moist, medium stiff -stiff to very stiff
		10					4.0	-gray, very stiff, low plasticity, trace fine gravel
10		15	102	20			3.0	**(FILL) SILTY SAND (SM)** gray, moist, loose to medium dense
		12	100	23			2.0	**(FILL) CLAY (CL)** olive-brown, moist, stiff -medium stiff to stiff
15						-#200=30%		**(FILL) CLAYEY SAND (SC)** - brown, medium dense, fine to coarse sand
		18						**(FILL) SILTY SAND (SM)** - brown, moist, medium dense, fine to coarse sand
20		10					1.5	**SILTY CLAY (CL)** mottled olive, moist, medium stiff, low plasticity
25		7					1.0	-olive-brown
								SILTY SAND (SM) brown, moist, loose, fine to medium sand
30		8					2.5	**SILTY CLAY (CL)** olive-brown, moist, medium stiff
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-6

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-7

Depth, ft	FIELD		LABORATORY				Pen, tsf	DESCRIPTION
	Sample	Blows/ft	Dry Density pcf	Moisture Content %	Compress. Strength tsf	Other Tests		(Continued from previous plate)
		9					<.5	-soft
40		19				-#200=32%		**SILTY SAND (SM)** mottled olive-brown, moist, medium dense, fine sand
								Bottom of Boring No free water encountered Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-6

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-7
(cont'd)

Date Completed: 2/11/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 23 feet (MSL)
		17	124	11				**(FILL) BASEROCK** - brown, moist, medium dense, some clay, fine to coarse sand and gravel
		16	119	11		LL=39, PI=20	2.0	**(FILL) CLAY (CL)** - brown, moist, medium stiff to stiff
5		11	104	10				-some fine gravel **(FILL) CLAYEY SAND (SC)** - olive, moist, medium dense, fine to coarse sand with a trace of gravel
		8	102	23			2.0	**(FILL) CLAY (CL)** - brown, moist, stiff
10		14				LL=36, PI=19	3.0	-gray, some fine gravel
		7					2.0	
15		7				-#200=4%		**POORLY GRADED SAND (SP)** - gray, moist, loose, fine to coarse sand
20		26	114	12		-#200=5%		-medium dense
25		7						**CLAYEY SAND (SC)** - brown, moist, loose, fine to medium sand
30		11						
35								**CLAY (CL)** - olive-brown, moist, medium stiff to stiff

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-7

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-8

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
	■	20					2.0	
40	■	13					2.5	-mottled olive-brown, stiff
								Bottom of Boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-7

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-8
(cont'd)

Date Completed: 2/11/99

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LAB: Dry Density pcf	LAB: Moisture Content %	LAB: Compress. Strength tsf	LAB: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 22 feet (MSL)
		11	116	12		-#200=19%		**(FILL) POORLY GRADED SAND WITH GRAVEL (SP)** - brown, moist, fine to coarse gravel, well graded
		19	116	12			3.5	**(FILL) CLAYEY SAND (SC)** - yellow-brown, moist, medium dense, fine to coarse sand with fine gravel
5		38						**(FILL) CLAY (CL)** - olive, moist, stiff, some fine gravel
		8	99	15				**(FILL) SILTY SAND WITH GRAVEL (SM)** - olive, moist, loose, fine gravel -trace of debris (wood)
10		15	100	22		LL=41, PI=20	3.5	**(FILL) CLAY (CL)** - gray, moist, stiff -gray, moist, trace of debris (wood)
		8						**SILTY SAND (SM)** - brown, moist, loose, fine sand
15		17					2.5	**SILTY CLAY (CL)** - dark brown, stiff, moist
20		20	125	9		-#200=7%		**POORLY GRADED SAND WITH SILT AND GRAVEL(SP-SM)** - brown, moist, medium dense, fine to coarse sand and gravel
25		25				-#200=7%		
30		7					<.5	**CLAY (CL)** - olive, moist, soft
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-8

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-9

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
								SILTY SAND (SM) - brown, wet, medium dense
40								**SILTY CLAY (CL)** - olive-brown, moist, medium stiff
		12					1.5	
								Bottom of Boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-8

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-9
(cont'd)

Date Completed: 2/11/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 20 feet (MSL)
		13	114	13				**(FILL) POORLY GRADED GRAVEL WITH CLAY (GP-GC)** - yellow-brown, moist, medium dense, fine to coarse gravel
		11					1.5	**(FILL) FAT CLAY (CH)** - dark brown, moist, stiff
5		12	93	26		LL=54, PI=34	2.5	-dark gray
		20					>4.5	-very stiff
10		11	94	17				-dark brown-olive, pockets of fine sand
		14	102	20			>.5	**CLAY (CL)** - olive, moist, soft to medium stiff
15		14	93 ▼	27			2.5	-dark brown, stiff, trace of roots
20		9	100	23			1.0	-mottled olive
							1.0	
25		6					<.5	-mottled olive, moist, soft to medium stiff
30		16					<.5	
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-9

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-10

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
	■	9					<.5	
40	■	12					1.0	-stiff
								Bottom of Boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-9

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-10
(cont'd)

Date Completed: 2/12/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 20 feet (MSL)
		10	124	12				**(FILL) POORLY GRADED SAND WITH GRAVEL (SP)** - yellow-brown, moist, loose, fine to coarse sand and gravel
		9				LL=49, PI=30	2.0	**(FILL) SANDY CLAY (CL)** - dark brown, moist, medium stiff to stiff
5		21					3.5	-brown
		23					>4.5	-mottled dark brown, very stiff, some fine gravel
10		9				PI=N.P.		**(FILL) SILTY SAND (SM)** - yellow-brown, moist, medium dense, fine grained
		12					3.0	**CLAY (CL)** - dark brown, very stiff, moist
15		10					2.0	-brown, medium stiff to stiff
20		14					>4.5	-olive-brown, very stiff
25		4					1.0	-medium stiff to stiff
							<.5	-soft to medium stiff
30		15					4.0	-very stiff
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-10

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-11

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		16						**POORLY GRADED SAND (SP)** - brown, wet, medium dense, trace of clay
40		16					1.5	**CLAY (CL)** - mottled olive-brown, moist, stiff
								Bottom of Boring Backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-10

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-11
(cont'd)

Date Completed: 2/12/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 17 feet (MSL)
		14	96	25				**(FILL) POORLY GRADED SAND (SP)** - brown, moist, medium dense, fine to coarse sand
		12	100	24			2.5	**(FILL) FAT CLAY (CH)** - dark brown, moist, stiff
5								-olive-brown
		14	103	24		LL=64, PI=45	2.0	
		14	98	27			4.0	-dark brown, very stiff
10								
		13	96	26			2.5	-stiff
		21	106	21			>4.5	-olive-brown -dark brown, very stiff
15								**CLAY (CL)** - brown, moist, stiff
		15	80	27			3.0	
20								
		7						-yellow-brown
25								-gray-brown, moist, soft to medium stiff
		5					0.5	
30								-yellow-brown, stiff
		18					1.5	
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-11

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-12

Depth, ft	FIELD		LABORATORY				Pen, tsf	DESCRIPTION
	Sample	Blows/ft	Dry Density pcf	Moisture Content %	Compress. Strength tsf	Other Tests		(Continued from previous plate)
		15					1.5	
40		16						Bottom of Boring No free water encountered Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-11

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-12
(cont'd)

Date Completed: 2/13/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 17 feet (MSL)
		16						**WELL GRADED GRAVEL (SW)** - brown, moist, medium dense, fine to coarse gravel
		10					2.0	**FAT CLAY (CH)** - olive-brown, moist, stiff
5		9					1.5	
		11					1.0	-gray
10		16				LL=65, PI=40	3.0	-alternating between brown and gray
		18					>4.5	-mottled gray, very stiff, trace organics (wood) -hard
15		16					3.0	-gray, stiff
20		14					2.5	-brown
25								**SILTY SAND (SM)** - brown, wet, loose to medium dense, medium sand
30		21					3.0	**CLAY (CL)** - brown, moist, very stiff
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-12

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-13

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		18					3.0	-olive
40		32						**POORLY GRADED SAND (SP)** - brown, wet, medium dense, with some silt
								Bottom of Boring
								Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-12

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-13
(cont'd)

Date Completed: 2/13/98

Logged By: M. Briseno

Total Depth: 41.5 ft

Sampler: Modified California Sampler - 2.5 in. O.D. 2.0 in. I.D., Standard Split Spoon Sampler - 2.0 in. O.D. 1.4 in. I.D.

Hammer Wt: 140 lbs., 30" drop

Depth, ft	FIELD: Sample	FIELD: Blows/ft	LABORATORY: Dry Density pcf	LABORATORY: Moisture Content %	LABORATORY: Compress. Strength tsf	LABORATORY: Other Tests	Pen, tsf	DESCRIPTION
								Surface Elevation: Estimated 17 feet (MSL)
		12	120	13				**POORLY GRADED SAND WITH GRAVEL (SP)** - brown, moist, medium dense, fine to coarse sand with gravel
		17	109	17			>4.5	**GRAVELLY CLAY (CL)** - brown, moist, very stiff, fine gravel
5		15				LL=36, PI=19	4.0	-very stiff
		11					3.0	
10		13	106	18			1.5	-gray-brown -stiff
15		11	99	24			1.5 1.5	-mottled gray -brown -gray
20		19	103	22			2.0	-olive
25		8					1.0	-mottled gray
30		14					3.5	-mottled brown, very stiff
35								

KLEINFELDER

PROJECT NO. 12-3039-40

LOG OF BORING NO. B-13

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-14

Depth, ft	FIELD Sample	FIELD Blows/ft	LABORATORY Dry Density pcf	LABORATORY Moisture Content %	LABORATORY Compress. Strength tsf	LABORATORY Other Tests	Pen, tsf	DESCRIPTION
								(Continued from previous plate)
		10					3.5	
40		26					4.0	-olive
								Bottom of Boring Boring backfilled with grout
45								
50								
55								
60								
65								
70								

KLEINFELDER

PROJECT NO. 12-3039-40

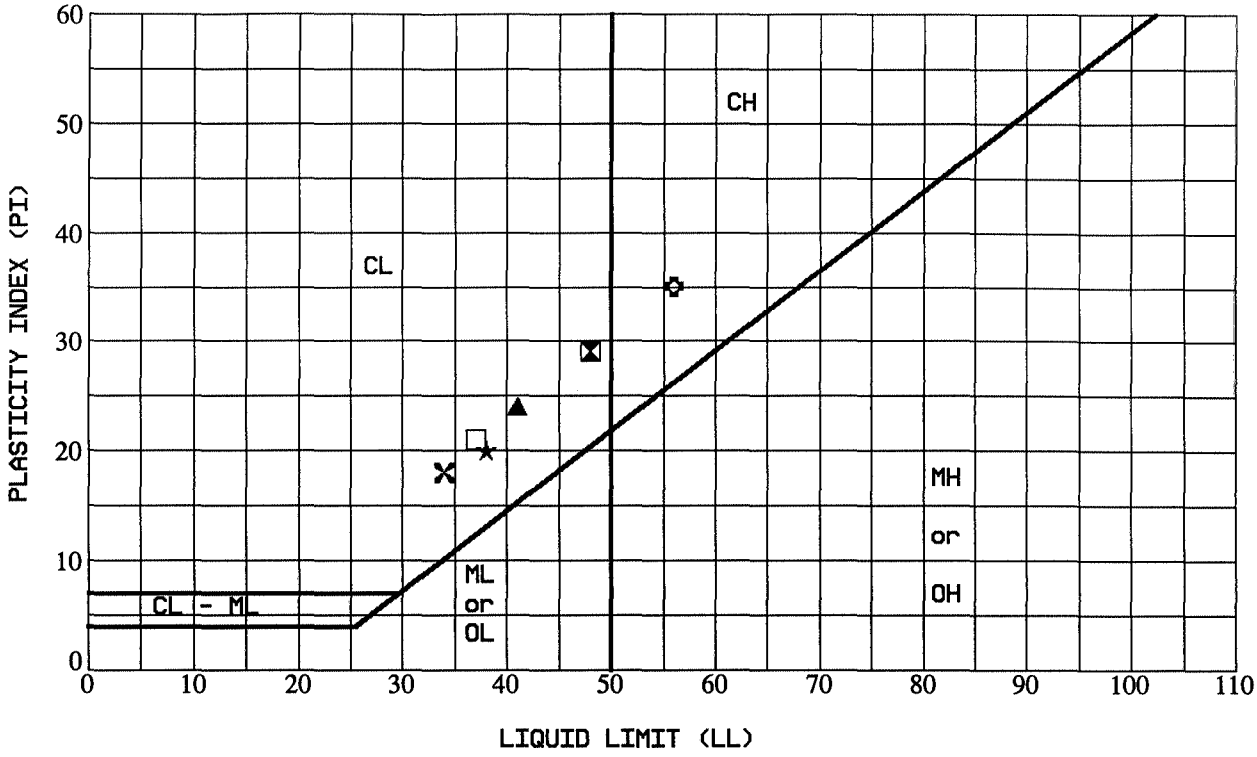
LOG OF BORING NO. B-13

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

PLATE

A-14
(cont'd)

Appendix B



Symbol	Boring	Depth	LL	PL	PI	Sample Description
□	B- 1	4.0	37	16	21	Brown Clay (CL)
⊠	B- 2	7.0	48	19	29	Gray Clay (CL)
▲	B- 3	3.5	41	17	24	Brown Sandy Clay (CL)
★	B- 3	7.5	38	18	20	Dark Gray Brown Silty Clay (CL)
✕	B- 3	13.0	34	16	18	Sandy Clay (CL)
✿	B- 3	20.0	56	21	35	Gray Brown Clay (CH)

Unified Soil Classification

Fine Grained Soil Groups

Symbol	LL < 50	Symbol	LL > 50
ML	Inorganic clayey silts to very fine sands of slight plasticity	MH	Inorganic silts and clayey silts of high plasticity
CL	Inorganic clays of low to medium plasticity	CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity	OH	Organic clays of medium to high plasticity, organic silts

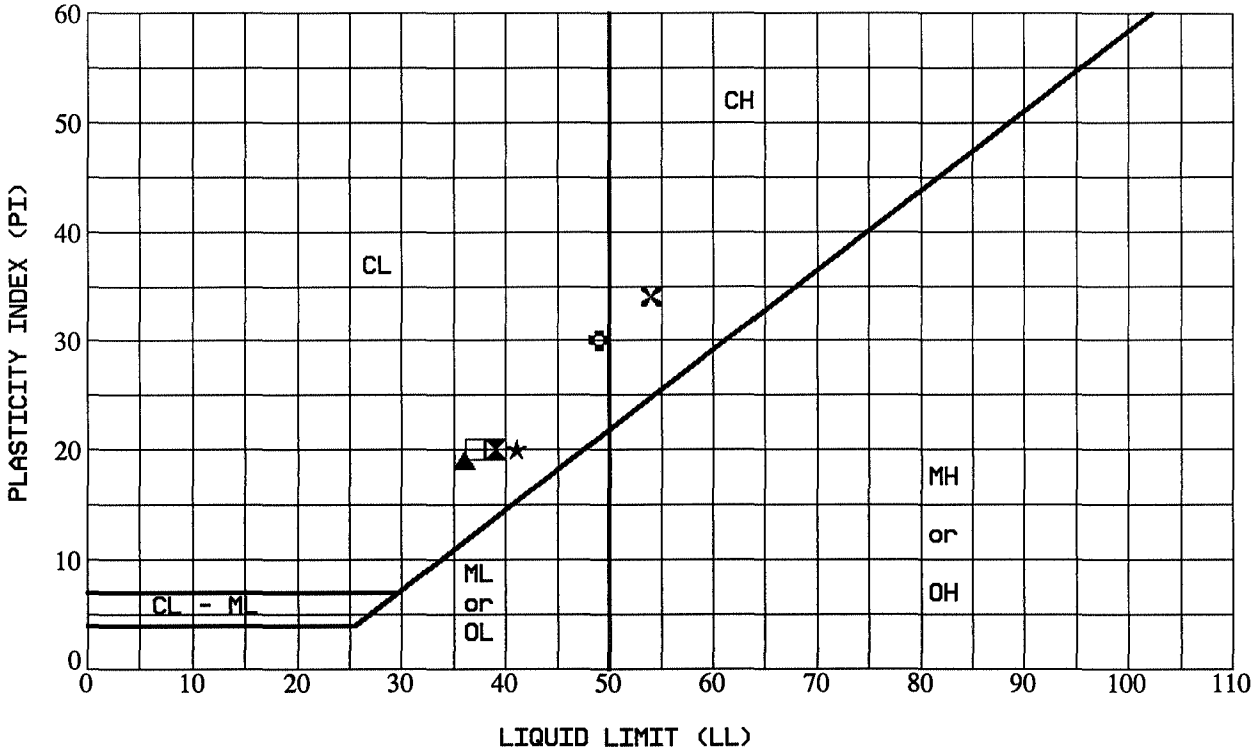
KLEINFELDER

PROJECT NO. 12-3039-40

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California
PLASTICITY CHART

PLATE

B-1



Symbol	Boring	Depth	LL	PL	PI	Sample Description
□	B- 4	6.5	37	17	20	Brown Clayey Sand (SC)
⊠	B- 7	3.0	39	19	20	Brown Sandy Clay (CL)
▲	B- 7	10.5	36	17	19	Brown Clay (CL)
★	B- 8	10.5	41	21	20	Gray Clay (CL)
✕	B- 9	5.5	54	20	34	Dark Brown Fat Clay (CH)
✿	B-10	3.0	49	19	30	Dark Brown Sandy Clay (CL)

Unified Soil Classification

Fine Grained Soil Groups

Symbol	LL < 50	Symbol	LL > 50
ML	Inorganic clayey silts to very fine sands of slight plasticity	MH	Inorganic silts and clayey silts of high plasticity
CL	Inorganic clays of low to medium plasticity	CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity	OH	Organic clays of medium to high plasticity, organic silts

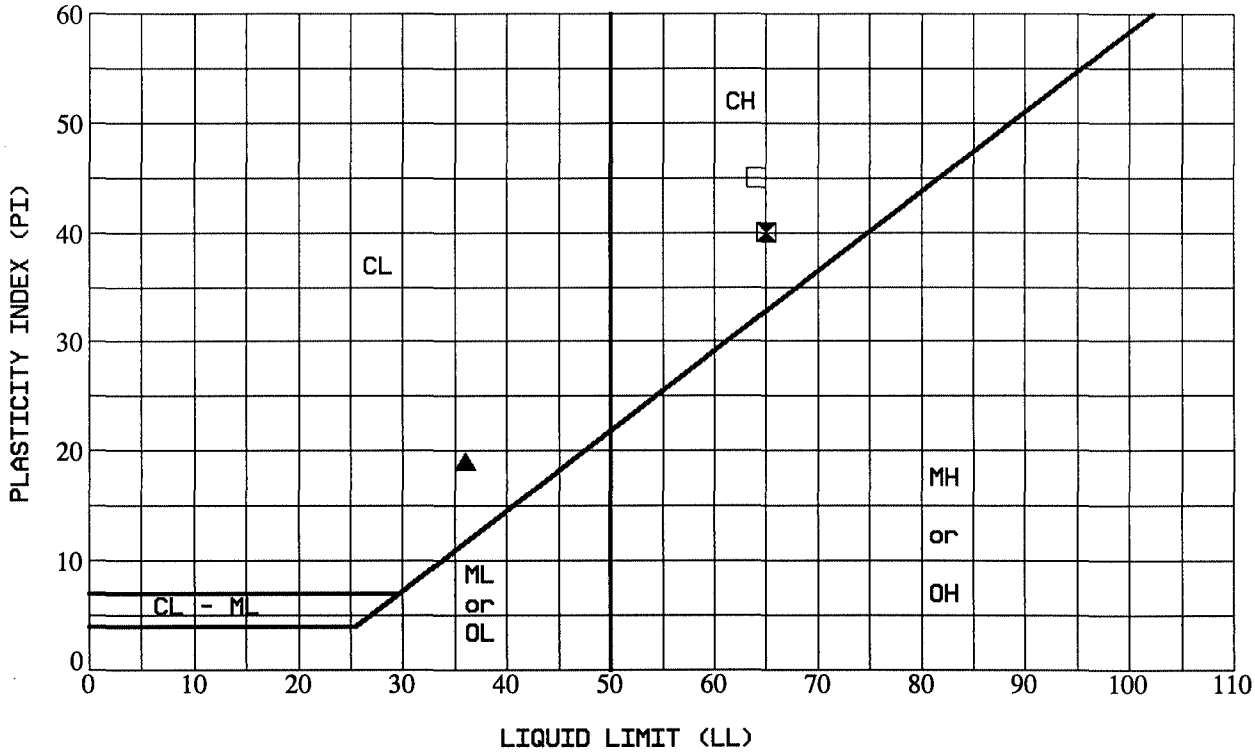
KLEINFELDER

PROJECT NO. 12-3039-40

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California
PLASTICITY CHART

PLATE

B-2



Symbol	Boring	Depth	LL	PL	PI	Sample Description
□	B-11	5.5	64	19	45	Dark Brown Fat Clay (CH)
⊠	B-12	11.0	65	25	40	Dark Brown Fat Clay (CH)
▲	B-13	6.0	36	17	19	Brown Sandy Clay (CL)

Unified Soil Classification

Fine Grained Soil Groups

Symbol	LL < 50	Symbol	LL > 50
ML	Inorganic clayey silts to very fine sands of slight plasticity	MH	Inorganic silts and clayey silts of high plasticity
CL	Inorganic clays of low to medium plasticity	CH	Inorganic clays of high plasticity
OL	Organic silts and organic silty clays of low plasticity	OH	Organic clays of medium to high plasticity, organic silts

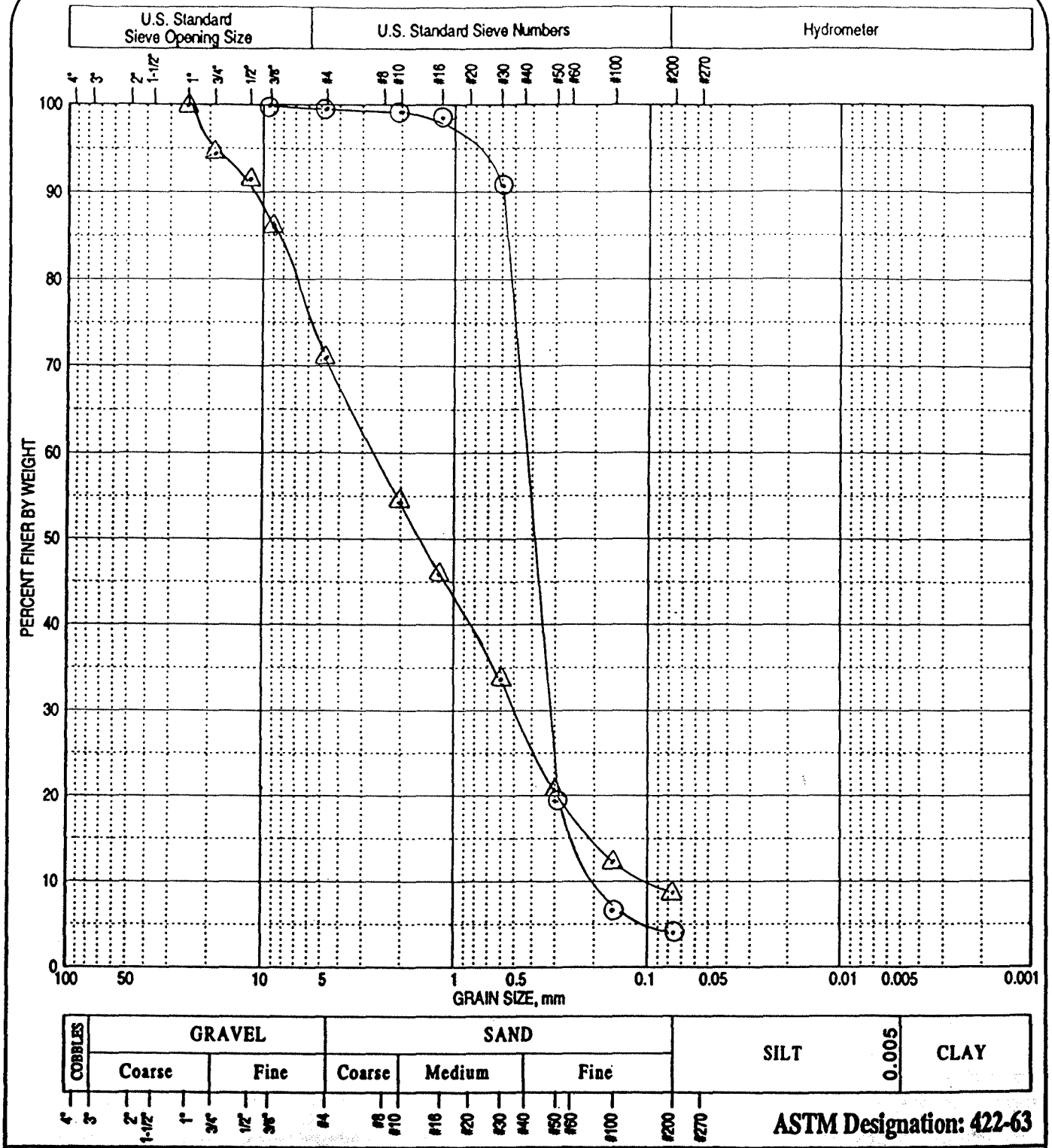
KLEINFELDER

PROJECT NO. 12-3039-40

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California
PLASTICITY CHART

PLATE

B-3



Symbol	Sample Source	Classification
⊙	B1 at 40.5 ft.	Gray fine Sand SP
△	B1 at 41.0 ft.	Gray Gravelly Sand trace ClaySP/SC

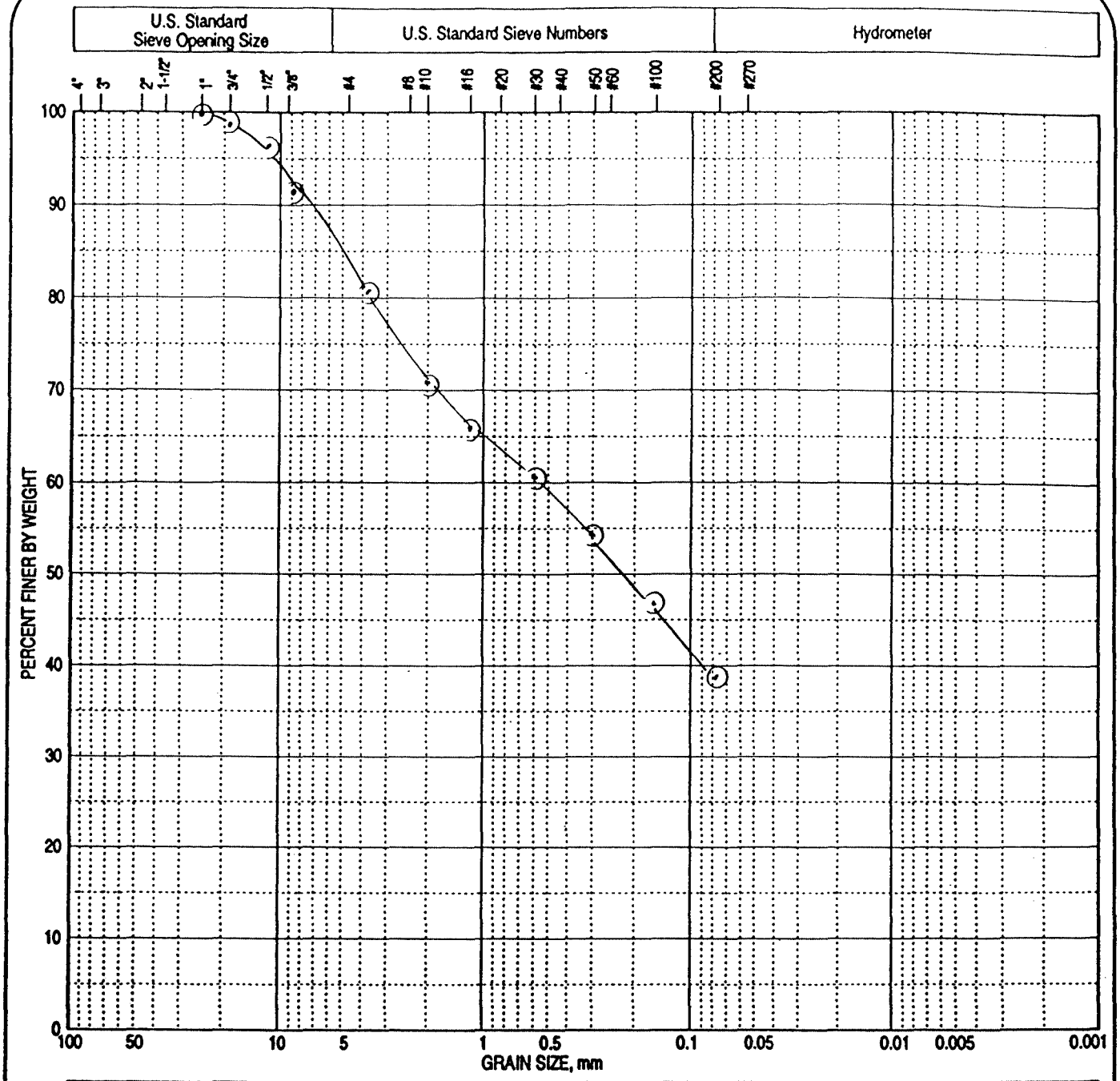
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PARTICLE-SIZE ANALYSIS

Proj. No. 1330.01 *Date:* 3/31/98 *App'd by:*

FIGURE B-4



ASTM Designation: 422-63

Symbol	Sample Source	Classification
⊙	B3 at 6.0 ft.	Gray clayey Sand little gravel SC

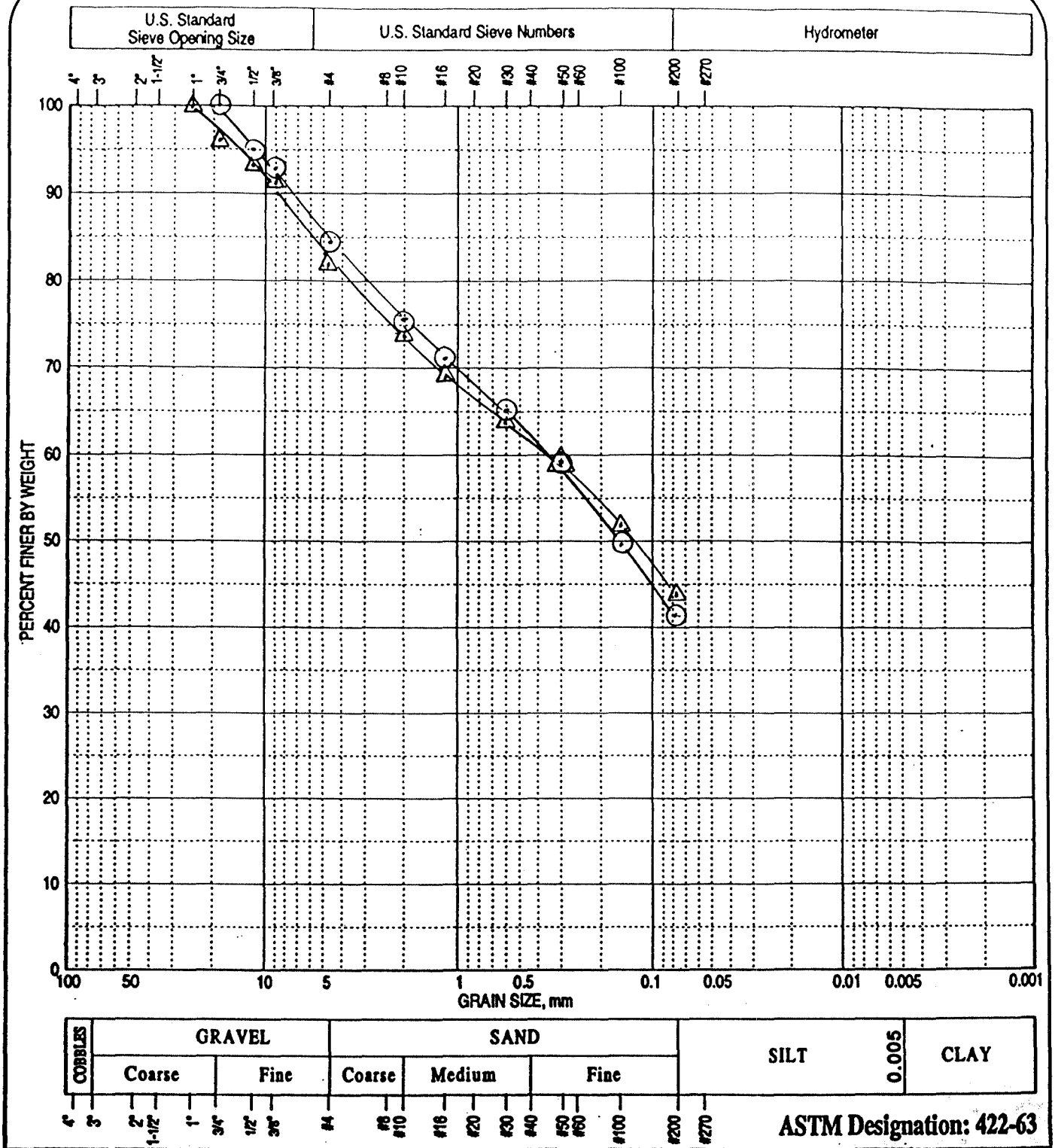
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FIGURE B-5



ASTM Designation: 422-63

Symbol	Sample Source	Classification
⊙	B 4 at 2.5 ft.	Gravelly CLAYEY SAND SC
△	B 4 at 4.5 ft.	Gravelly CLAYEY SAND SC

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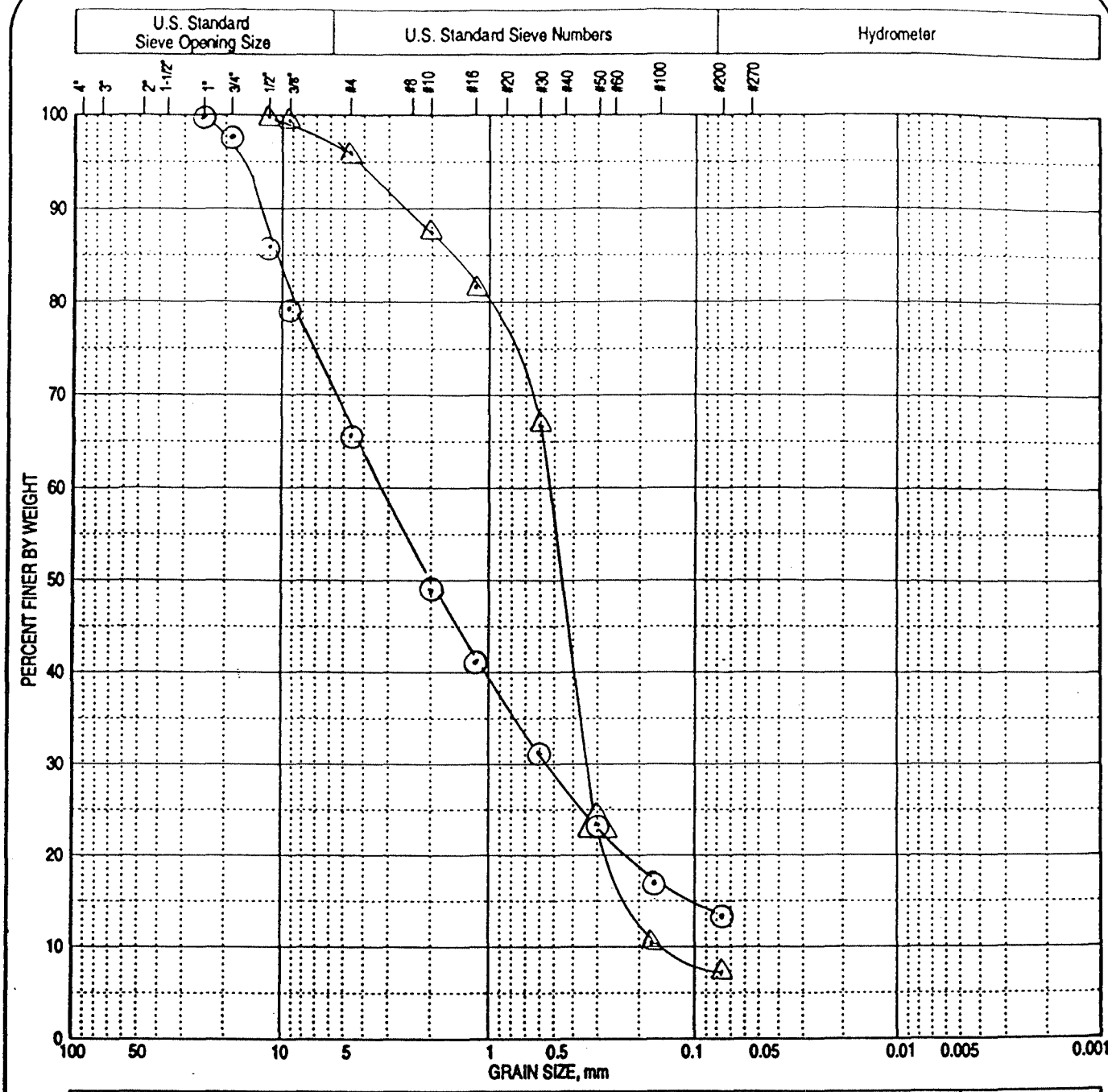
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FIGURE

B-6



Symbol	Sample Source	Classification
⊙	B4 at 36.0 ft.	Gray Gravelly Sand little claySC
△	B4 at 40.0 to 41.5 ft	Gray F-C Sand trace clay SP/SC

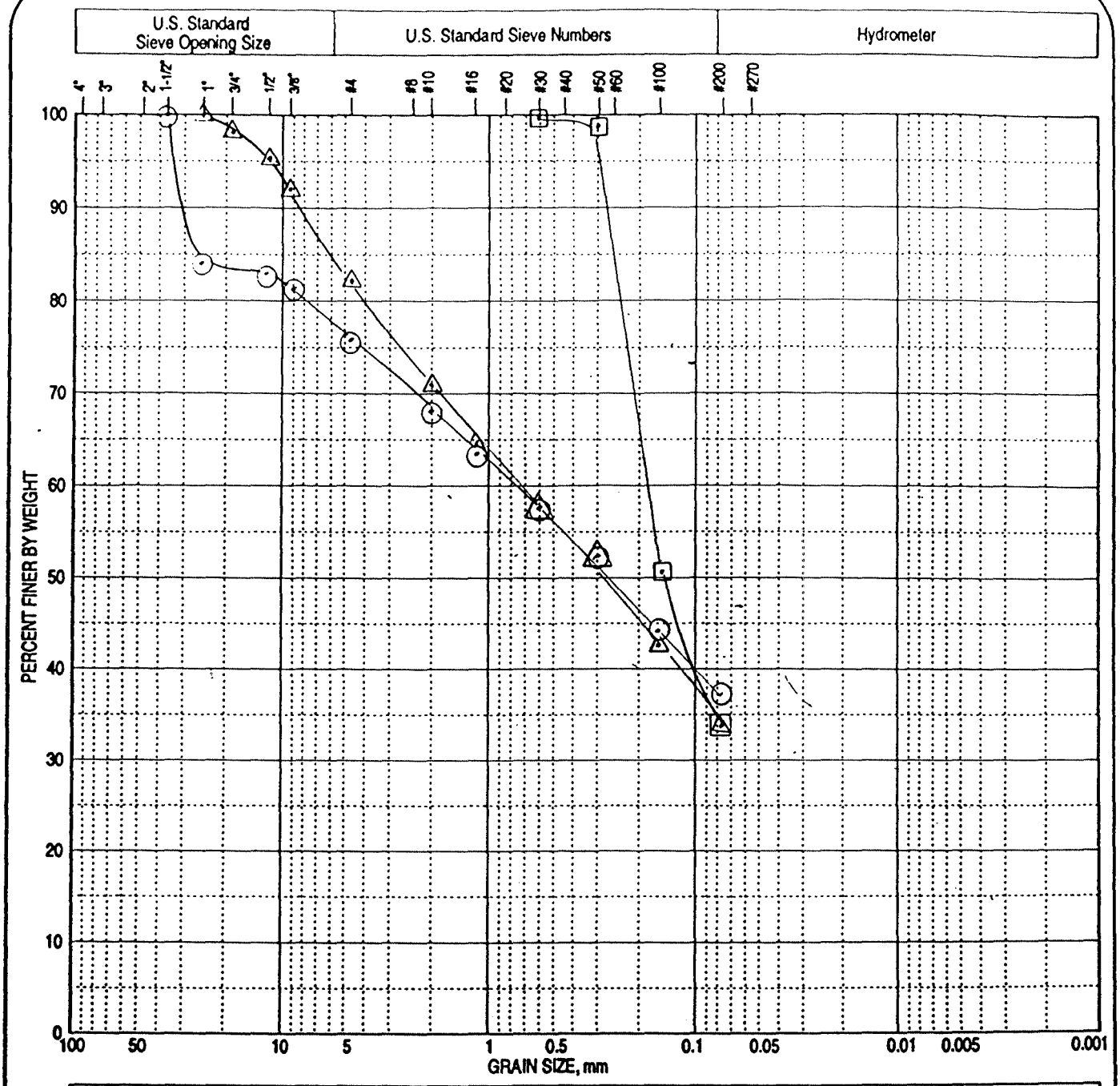
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PARTICLE-SIZE ANALYSIS

FIGURE B-7

Proj. No. 1330.01 *Date:* 3/31/98 *App'd by:*



ASTM Designation: 422-63

Symbol	Sample Source	Classification
⊙	B 5 at 5.0 ft.	CLAYEY SAND some Gravels SC
△	B 5 at 7.0 ft.	CLAYEY SAND little Gravel SC
⊡	B 5 at 11.0 ft.	SILTY SAND SM

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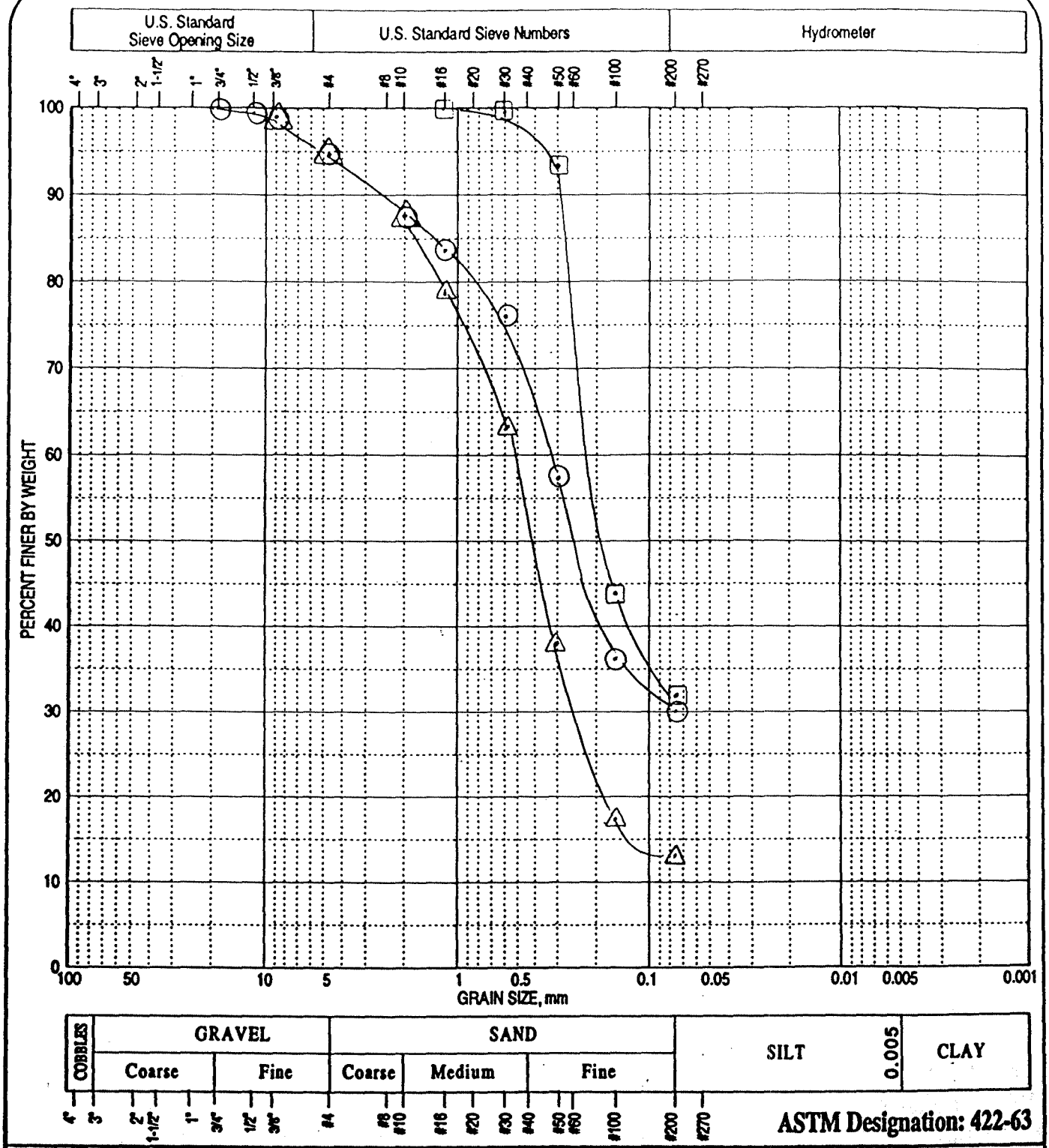
Consulting Engineers and Geologists

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Proj. No. 1330.01 *Date:* 4/24/98 *App'd by:*

FIGURE

B-8



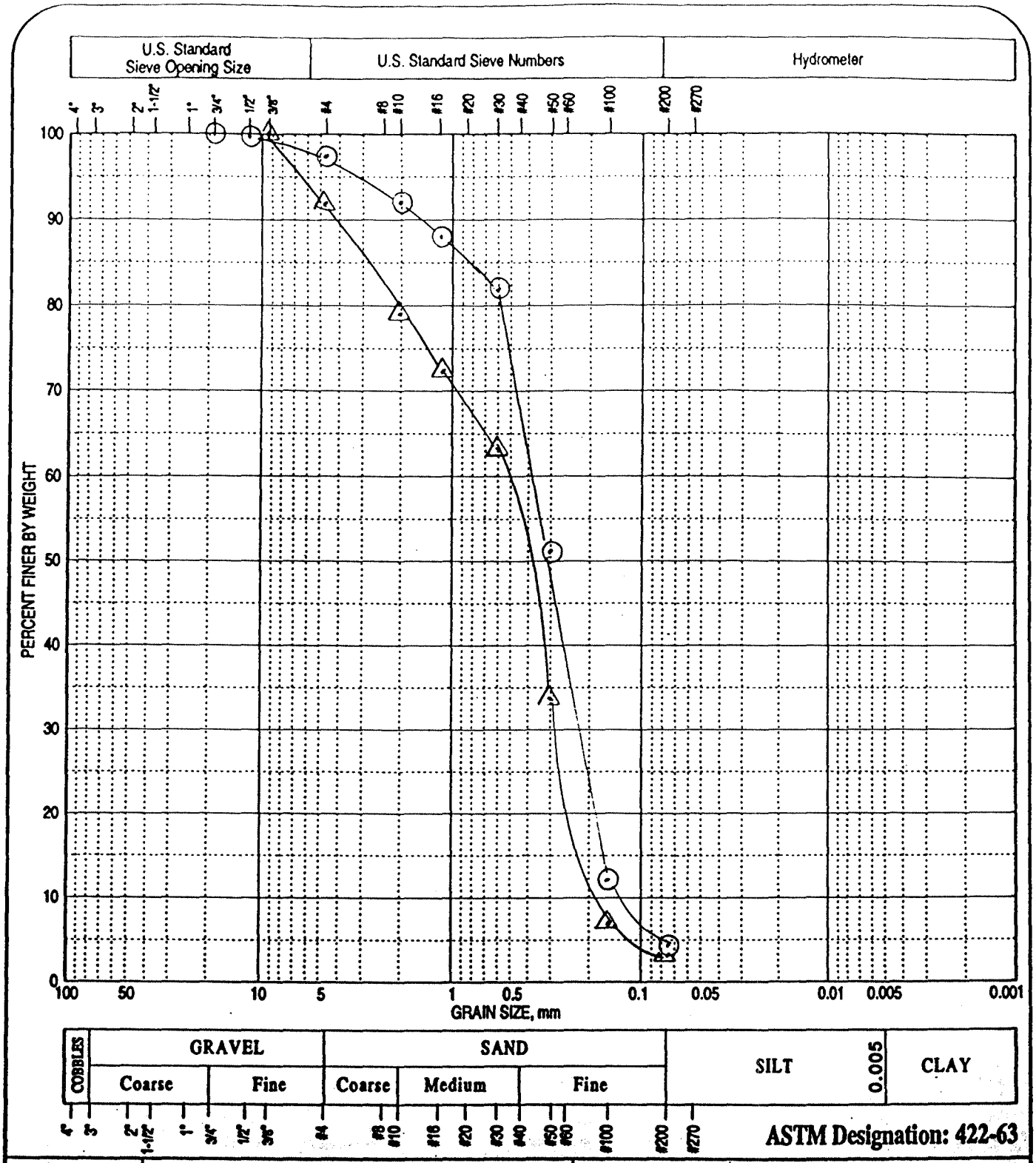
Symbol	Sample Source	Classification
⊙	B 6 at 15.5 ft.	CLAYEY SAND trace Gravel SC
△	B 6 at 16.0 ft.	SILTY SAND SM
◰	B 6 at 41.0 ft.	SILTY SAND SM

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PARTICLE-SIZE ANALYSIS

FIGURE B-9

Proj. No. 1330.01 Date: 4/24/98 App'd by:



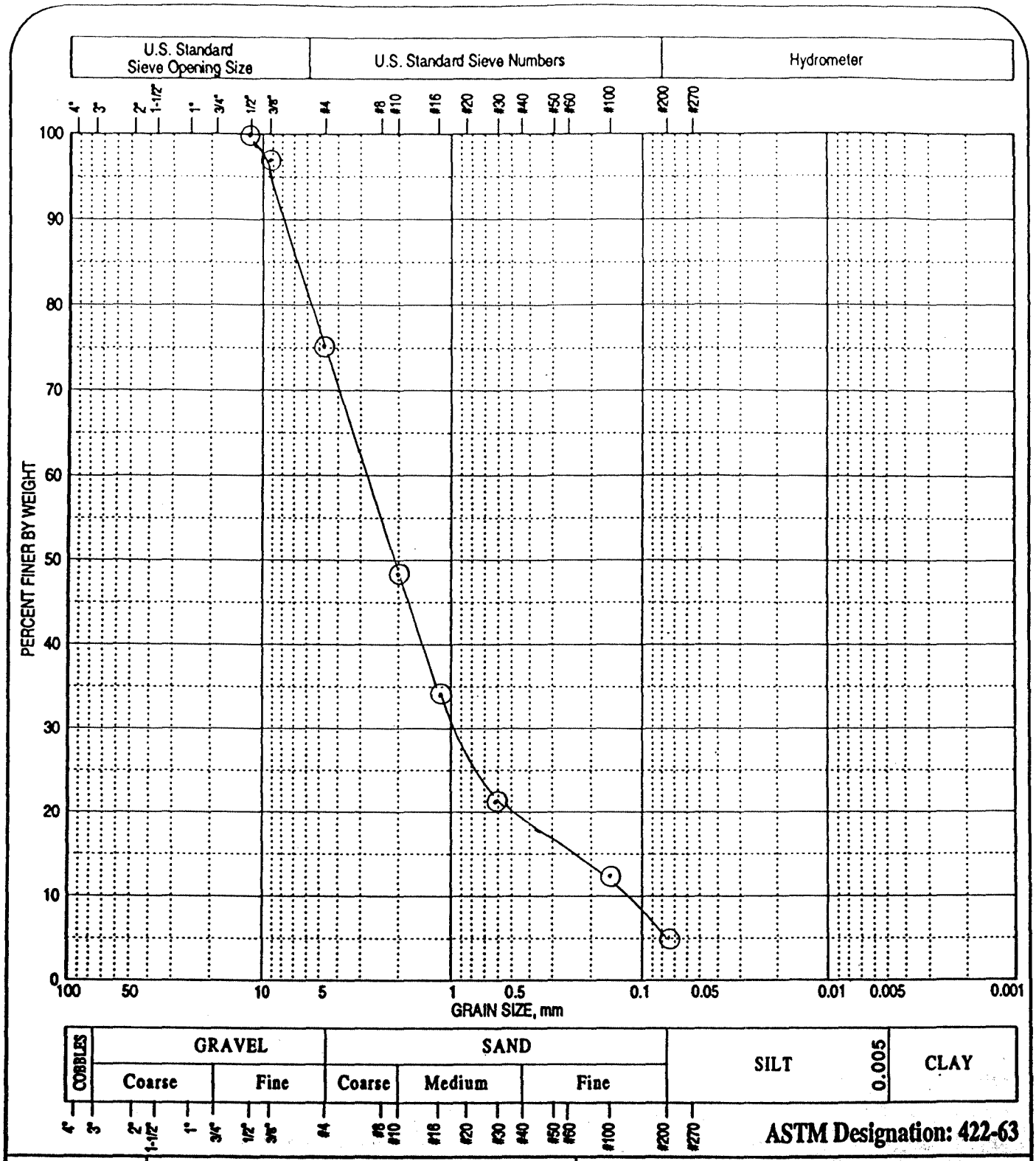
Symbol	Sample Source	Classification
⊙	B7 at 17.4 ft.	Brown Sand trace silt SP
△	B7 at 16.7 ft.	Brown Sand trace silt SP

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Proj. No. 1330.01 *Date:* 3/31/98 *App'd by:*

FIGURE B-10



ASTM Designation: 422-63

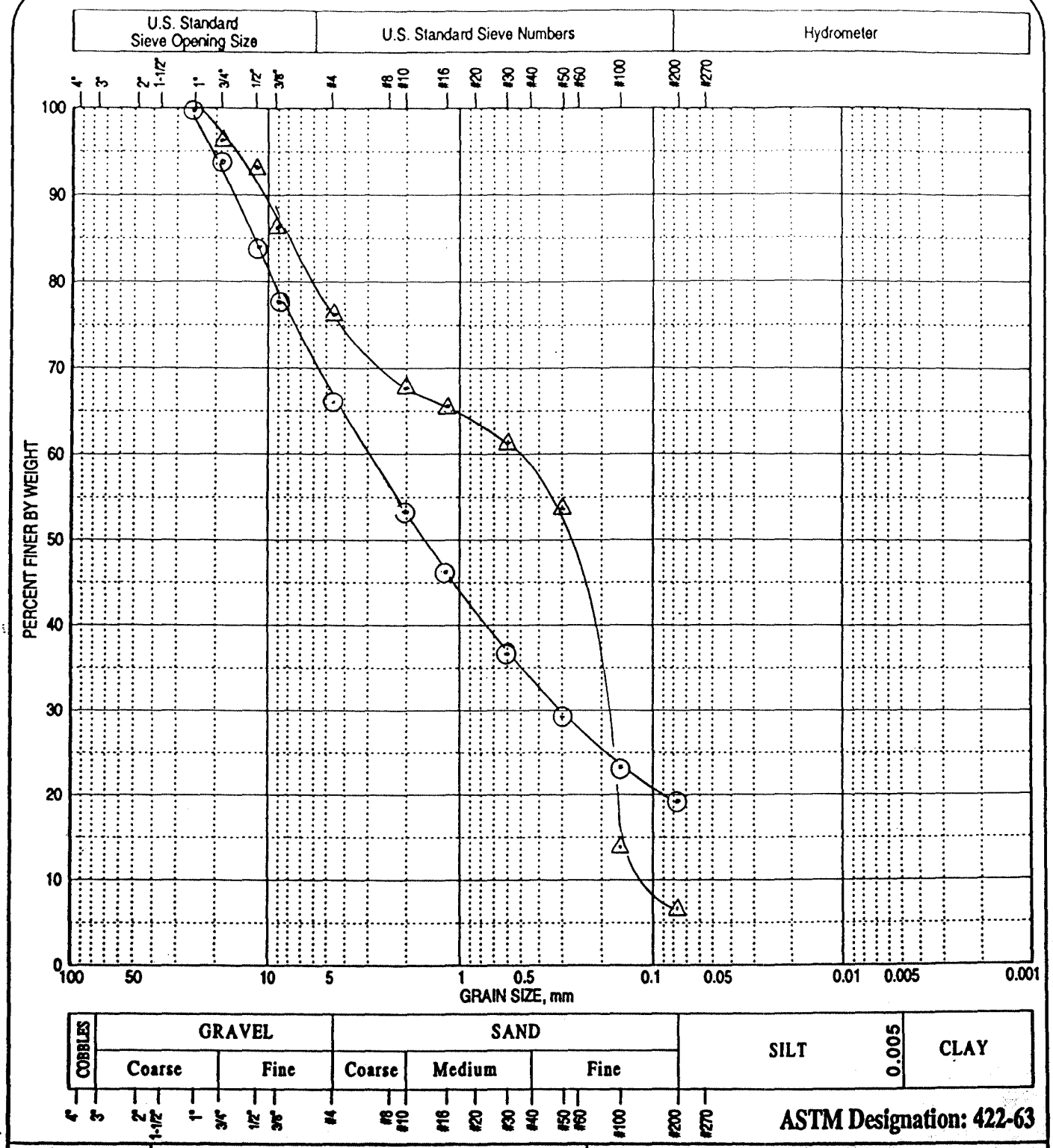
Symbol	Sample Source	Classification
⊙	B 7 at 21.0 ft.	Gravelly SAND trace Silt SP/SM

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FIGURE
B-11



Symbol	Sample Source	Classification
⊙	B 8 at 6.0 ft.	Gravelly SAND little Silt SM
△	B 8 at 21.0 ft	Gravelly SAND trace Silt SP/SM

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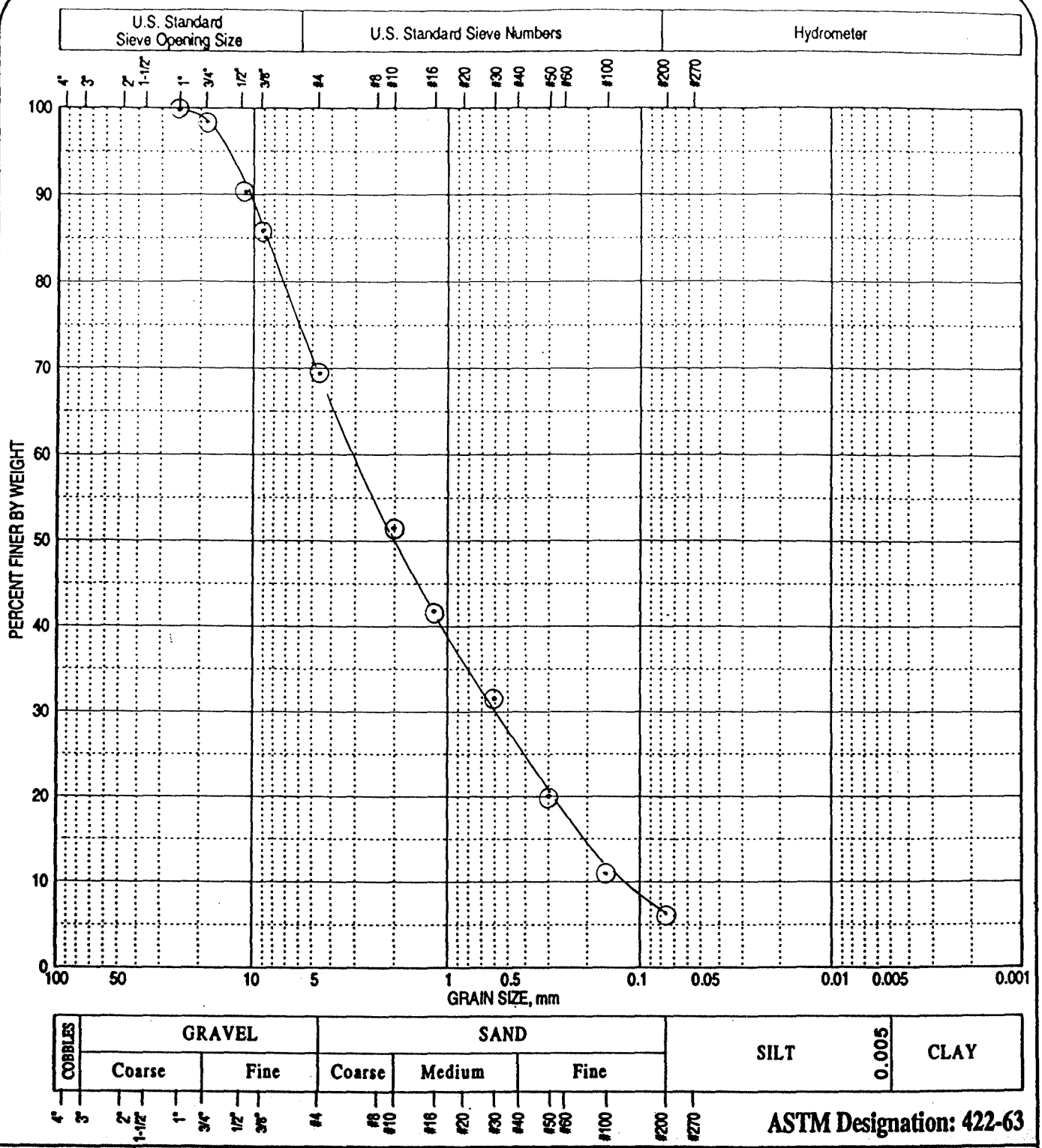
Consulting Engineers and Geologists

PARTICLE-SIZE ANALYSIS

Proj. No. 1330.01 *Date:* 4/24/98 *App'd by:*

FIGURE

B-12



ASTM Designation: 422-63

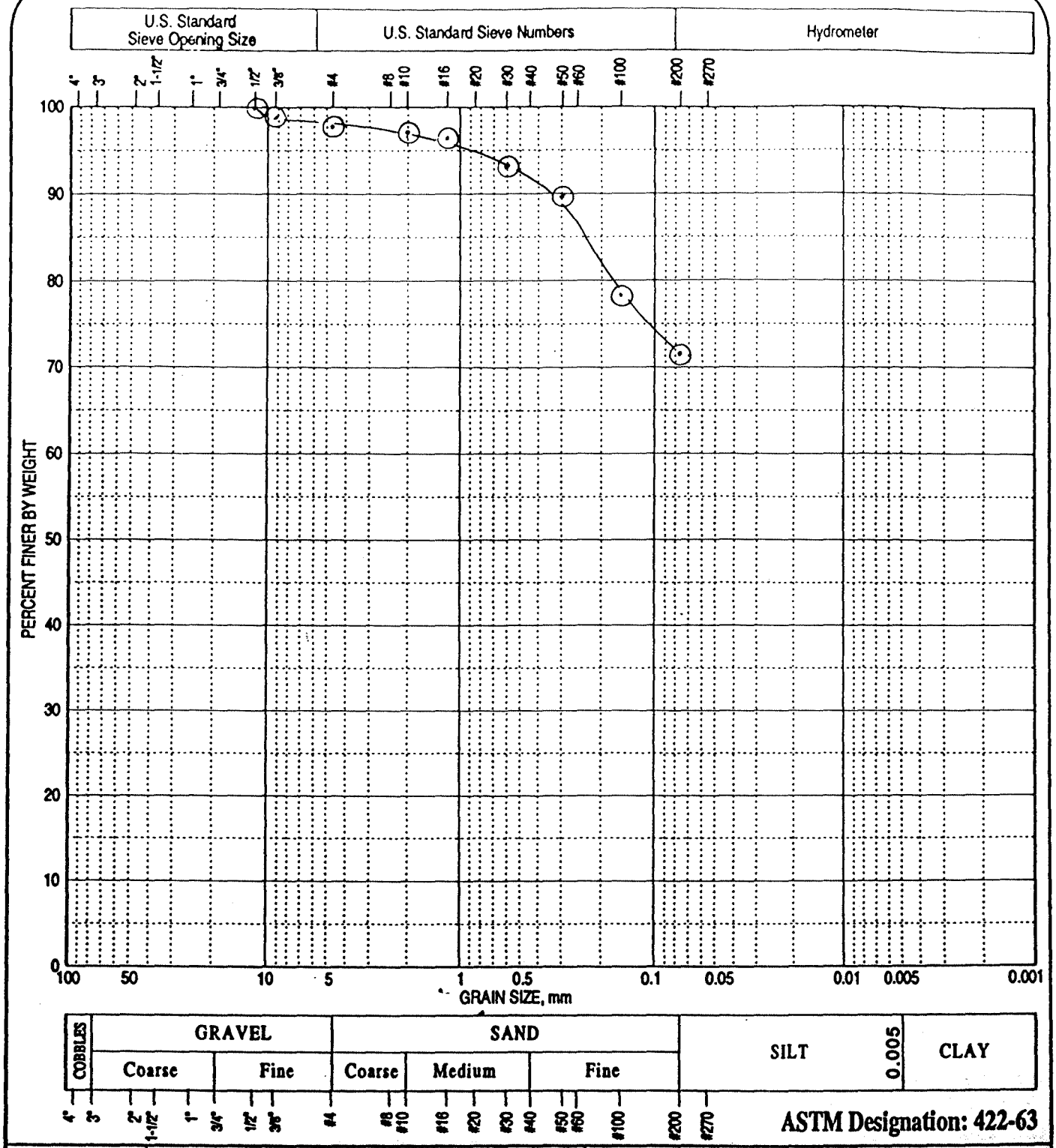
Symbol	Sample Source	Classification
⊙	B 8 at 26.0 ft.	Gravelly SAND trace Silt SM/SP

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PARTICLE-SIZE ANALYSIS

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FIGURE **B-13**



ASTM Designation: 422-63

Symbol	Sample Source	Classification
⊙	B 10 at 8.5 ft.	SANDY CLAY CL

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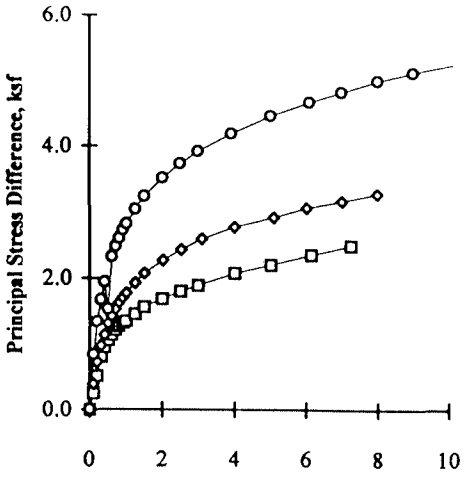
Consulting Engineers and Geologists

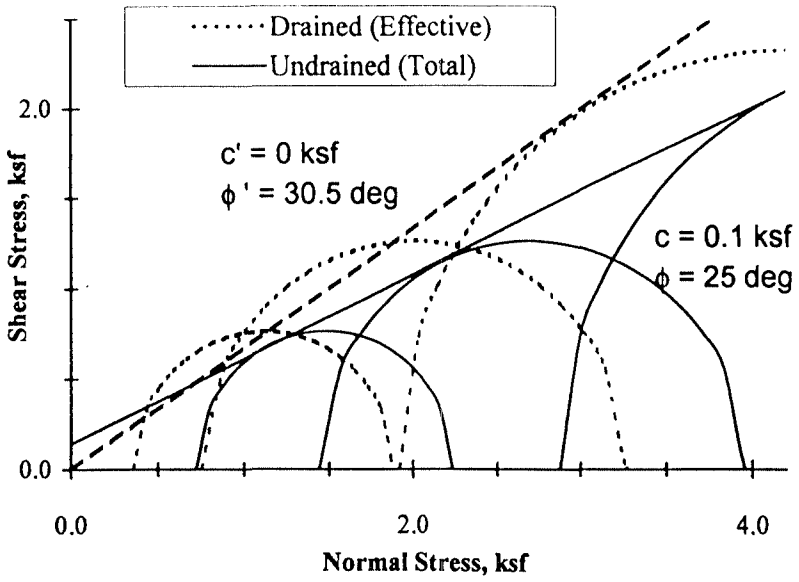
PARTICLE-SIZE ANALYSIS

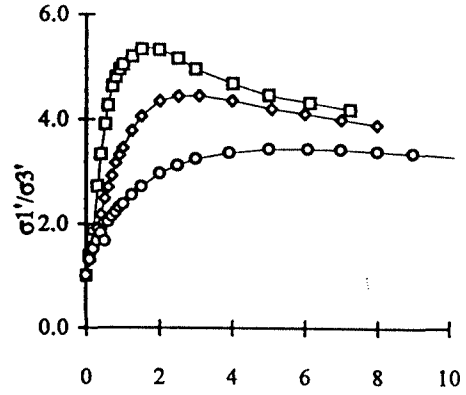
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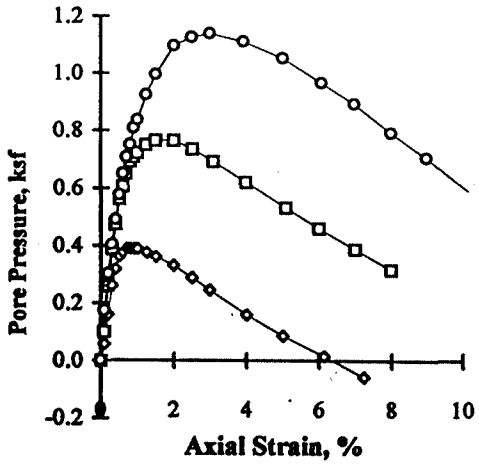
FIGURE

B-14









SAMPLE DATA	TEST NUMBER		
	1	2	3
Symbol	◇	□	○
Boring	3	3	3
Depth ft. /Sample No.	5.5	10.5	11
Initial			
Water Content, %	15.7%	22.6%	19.6%
Dry Density, pcf	114.5	99.8	104.82
Saturation, %	89.8%	91.2%	86.6%
Void Ratio	0.472	0.657	0.613
Initial Area, cm^2	29.70	29.61	29.70
Initial Height, cm	14.0	12.7	12.70
At Test (Post Consolidation)			
Final Water Content, %	17.8%	25.1%	21.0%
Dry Density, pcf	113.8	98.8	107.7
Saturation, %	100%	98.7%	100%
Void Ratio	0.481	0.674	0.571
Consol. Pressure, kips/sq.ft..	0.72	1.44	2.88
Major Principal Stress, ksf	2.24	3.96	7.55
Minor Principal Stress, ksf	0.72	1.44	2.88
Excess Pore Pressure, ksf	0.36	0.69	0.97
Strain. %	1.5	3.1	2.3

Type of Test: TX/CU, with pore pressure measurements
Method of Saturation: Back Pressure
Rate of Strain 0.026%/min
Remarks

Classification
◇ Boring 3, 5.5 feet
□ Boring 3, 10.5 feet
○ Boring 3, 11 feet

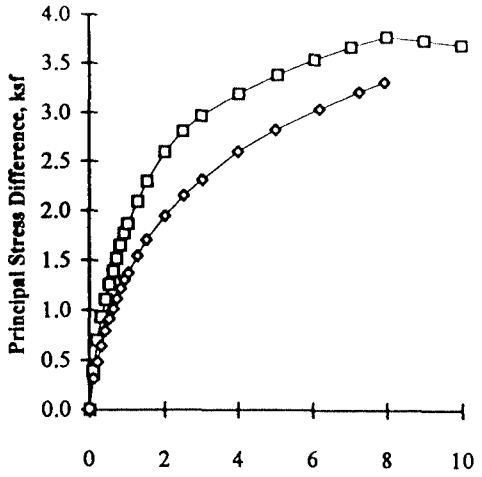
HTA Harlan Taft Associates
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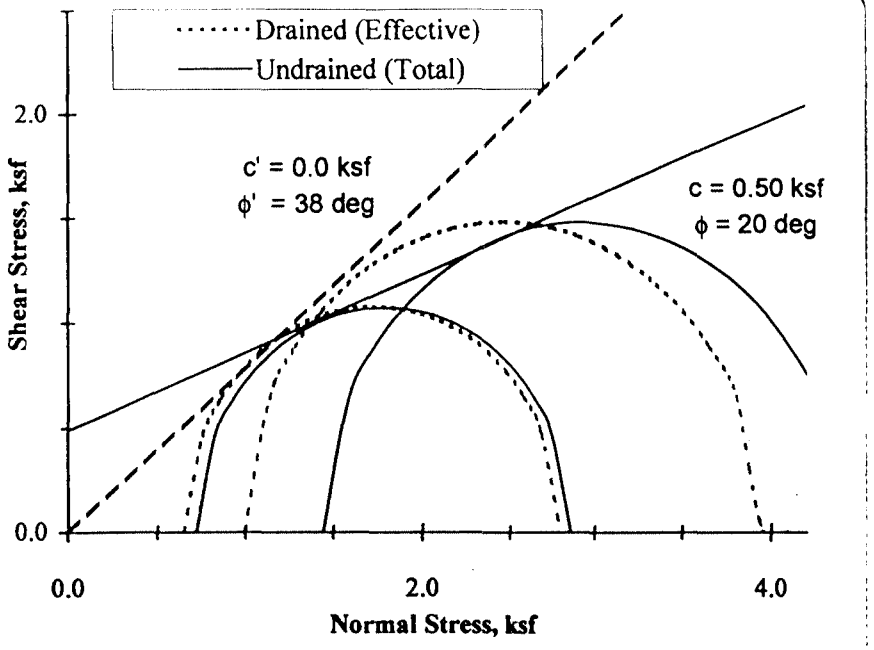
TRIAXIAL COMPRESSION TEST
San Thomas Aquino Creek Levee
Santa Clara Valley Water District

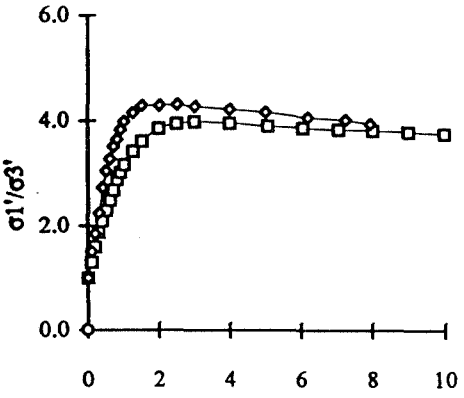
FIGURE B-15

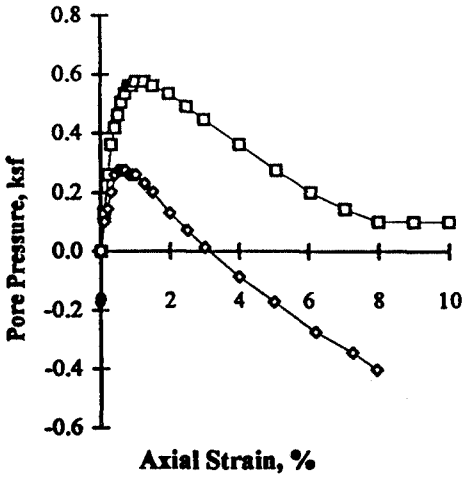
Proj. No 1330.010 *Date:* 5/29/98 *App'd by:*

F:\Spreadsheets\TX-CU Figures\SCVWD TX-CU's\[SCVW San Thomas B3.xls]Figure









SAMPLE DATA	TEST NUMBER 1	2	3
Symbol	□	◇	○
Boring	B3	B3	
Depth ft. /Sample No.	16-16.5	16.8-17.2	
Initial			
Water Content, %	25.4%	24.2%	
Dry Density, pcf	98.4	100.5	
Saturation, %	95.3%	95.6%	
Void Ratio	0.725	0.689	
Initial Area, cm^2	42.46	42.46	
Initial Height, cm	15.2	15.2	
At Test (Post Consolidation)			
Final Water Content, %	24.8%	24.2%	
Dry Density, pcf	101.7	102.4	
Saturation, %	100.7%	99.9%	
Void Ratio	0.669	0.658	
Consol. Pressure, kips/sq.ft..	1.44	0.72	
Major Principal Stress, ksf	4.40	2.86	
Minor Principal Stress, ksf	1.44	0.72	
Excess Pore Pressure, ksf	0.45	0.07	
Strain. %	3.0	2.5	

Type Test: TX/CU,
with pore pressure measurements
Method of Saturation: Back Pressure
Rate of Strain **0.022 %/min**
Remarks

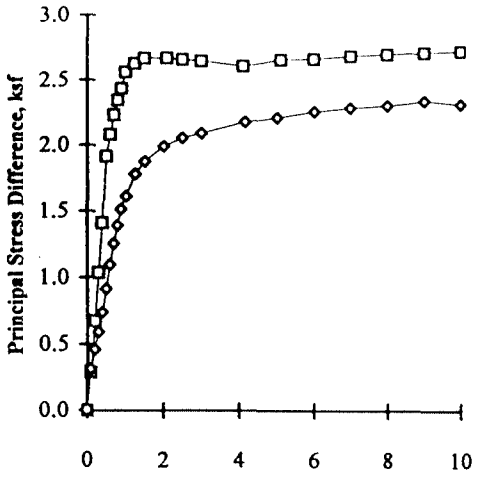
Classification: ◇ **Boring 3, 16 to 16.5 feet**
□ **Boring 3, 16.8 to 17.5 feet**
○

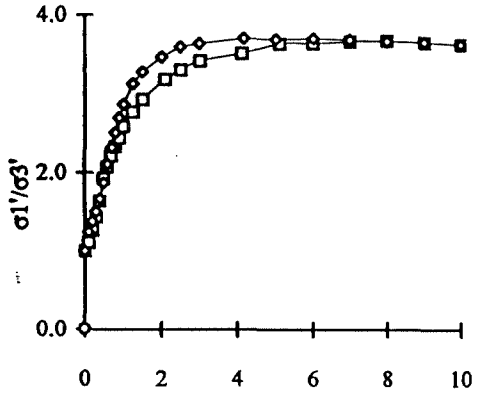
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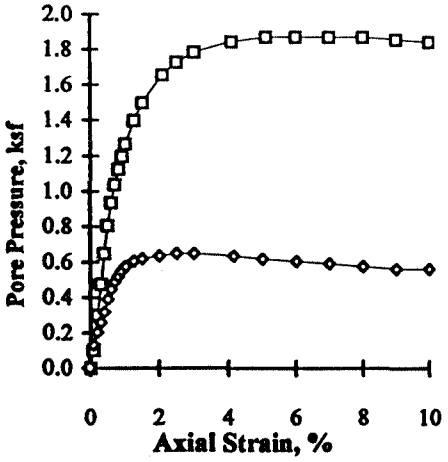
TRIAXIAL COMPRESSION TEST
San Thomas Creek Levees
Santa Clara Valley Water District

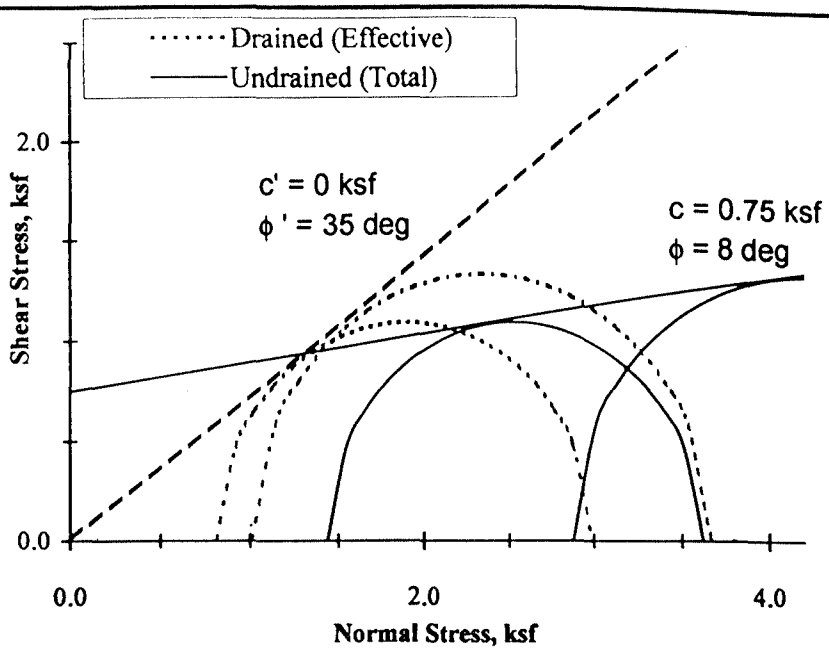
FIGURE
B-16

Proj. No 1276.010 *Date:* 3/13/98 *App'd by:*









SAMPLE DATA	TEST NUMBER 1	2	3
Symbol	◇	□	○
Boring	B10	B10	
Depth ft. /Sample No.	26.8	27-28	
Initial			
Water Content, %	32.9%	32.6%	
Dry Density, pcf	87.8	88.3	
Saturation, %	97.9%	97.8%	
Void Ratio	0.897	0.893	
Initial Area, cm^2	42.46	42.46	
Initial Height, cm	15.2	15.2	
At Test (Post Consolidation)			
Final Water Content, %	31.6%	32.7%	
Dry Density, pcf	90.2	89.0	
Saturation, %	99.4%	99.8%	
Void Ratio	0.848	0.878	
Consol. Pressure, kips/sq.ft..	2.88	1.44	
Major Principal Stress, ksf	5.54	3.62	
Minor Principal Stress, ksf	2.88	1.44	
Excess Pore Pressure, ksf	1.87	0.63	
Strain. %	8.0	4.2	

Type Test: TX/CU,
with pore pressure measurements
Method of Saturation: Back Pressure
Rate of Strain 0.026%/min
Remarks

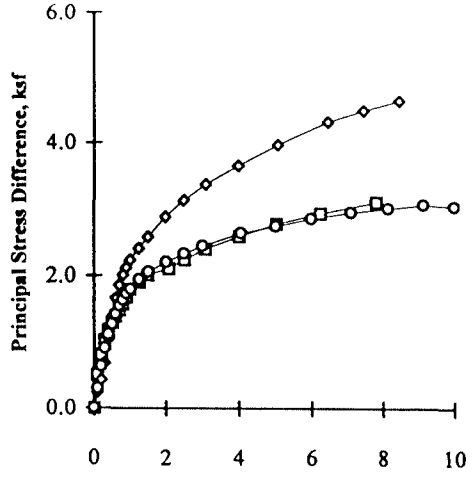
Classification
◇ Boring 10, 26.8 feet
□ Boring 10, 27 to 28 feet
○

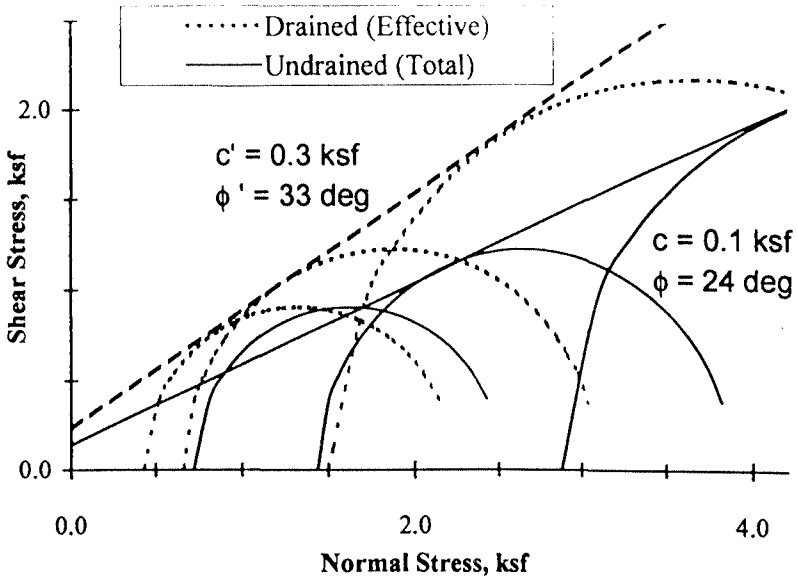
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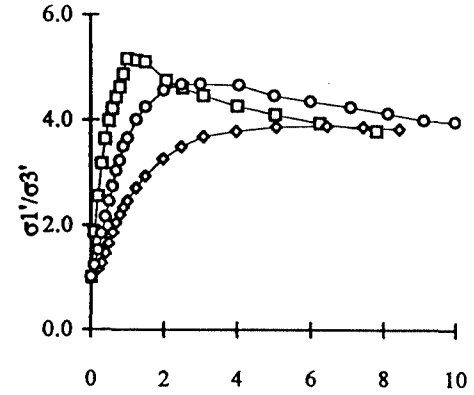
TRIAXIAL COMPRESSION TEST
San Thomas Aquino Creek
Santa Clara Valley Water District

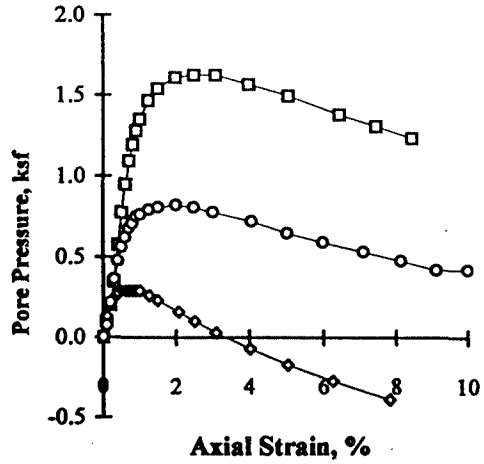
Proj. No 1276.010 *Date:* 3/25/98 *App'd by:*

FIGURE B-17









SAMPLE DATA	TEST NUMBER		
	1	2	3
Symbol	◇	□	○
Boring	9	10	10
Depth ft. /Sample No.	11	11	10.5
Initial			
Water Content, %	18.6%	18.5%	23.9%
Dry Density, pcf	101.0	89.5	91.27
Saturation, %	77.9%	60.1%	80.3%
Void Ratio	0.630	0.791	0.771
Initial Area, cm^2	30.04	29.98	29.95
Initial Height, cm	12.7	14.0	12.80
At Test (Post Consolidation)			
Final Water Content, %	23.5%	28.8%	29.3%
Dry Density, pcf	101.6	92.0	92.0
Saturation, %	100%	99.7%	100%
Void Ratio	0.622	0.743	0.757
Consol. Pressure, kips/sq.ft..	0.72	2.88	1.44
Major Principal Stress, ksf	2.52	7.24	3.88
Minor Principal Stress, ksf	0.72	2.88	1.44
Excess Pore Pressure, ksf	0.29	1.38	0.78
Strain. %	1.5	3.1	1.2

Type of Test: TX/CU, with pore pressure measurements
Method of Saturation: Back Pressure
Rate of Strain 0.03%/min
Remarks

Classification
◇ Boring 9, 11.0 feet
□ Boring 10, 11.0 feet
○ Boring 10, 10.5 feet

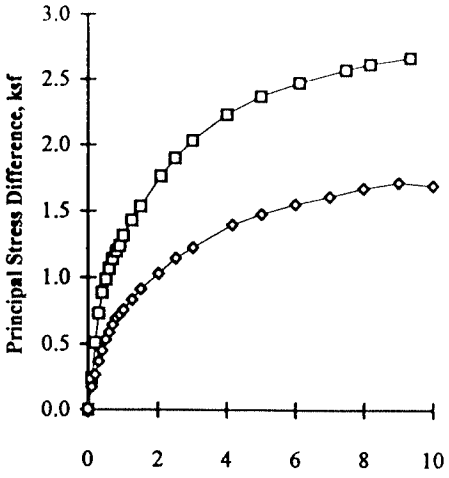
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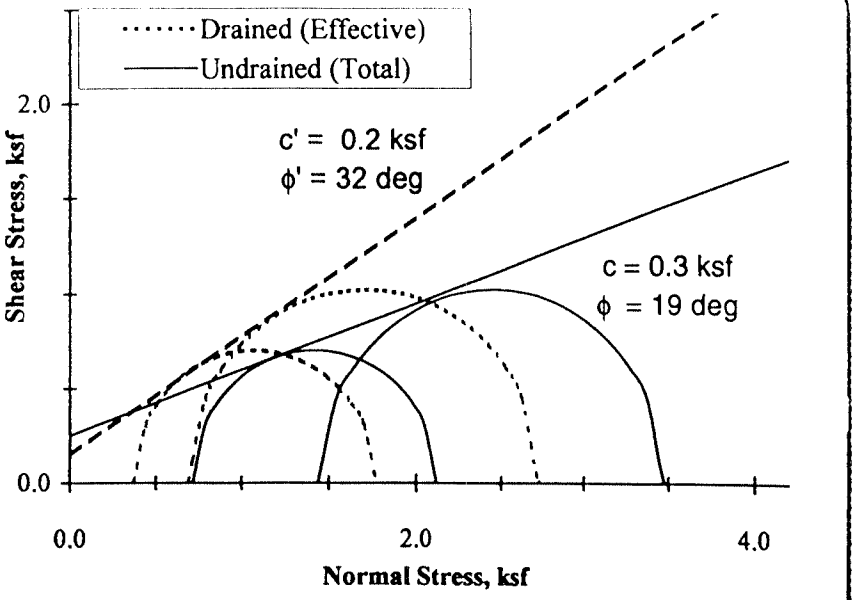
TRIAXIAL COMPRESSION TEST
San Tomas Aquino Creek Levee
Santa Clara Valley Water District

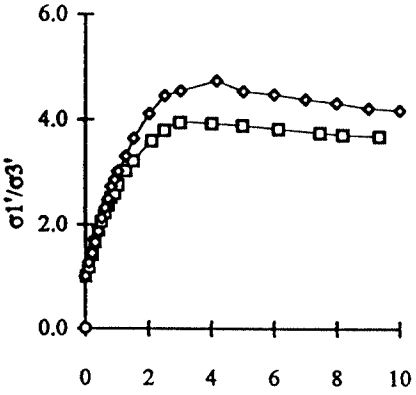
Proj. No 1330.010 *Date:* 6/5/98 *App'd by:*

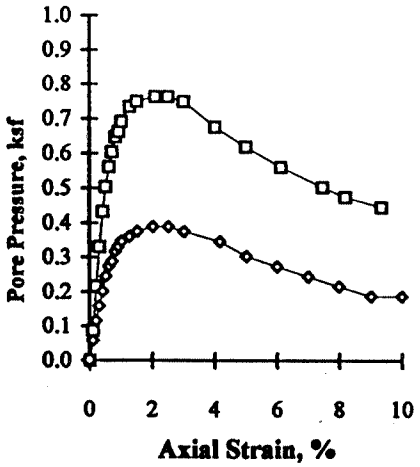
FIGURE **B-18**

F:\Spreadsheets\TX-CU Figures\SCVWD TX-CU's\[SCVW San Thomas B9,B10.xls]Figure









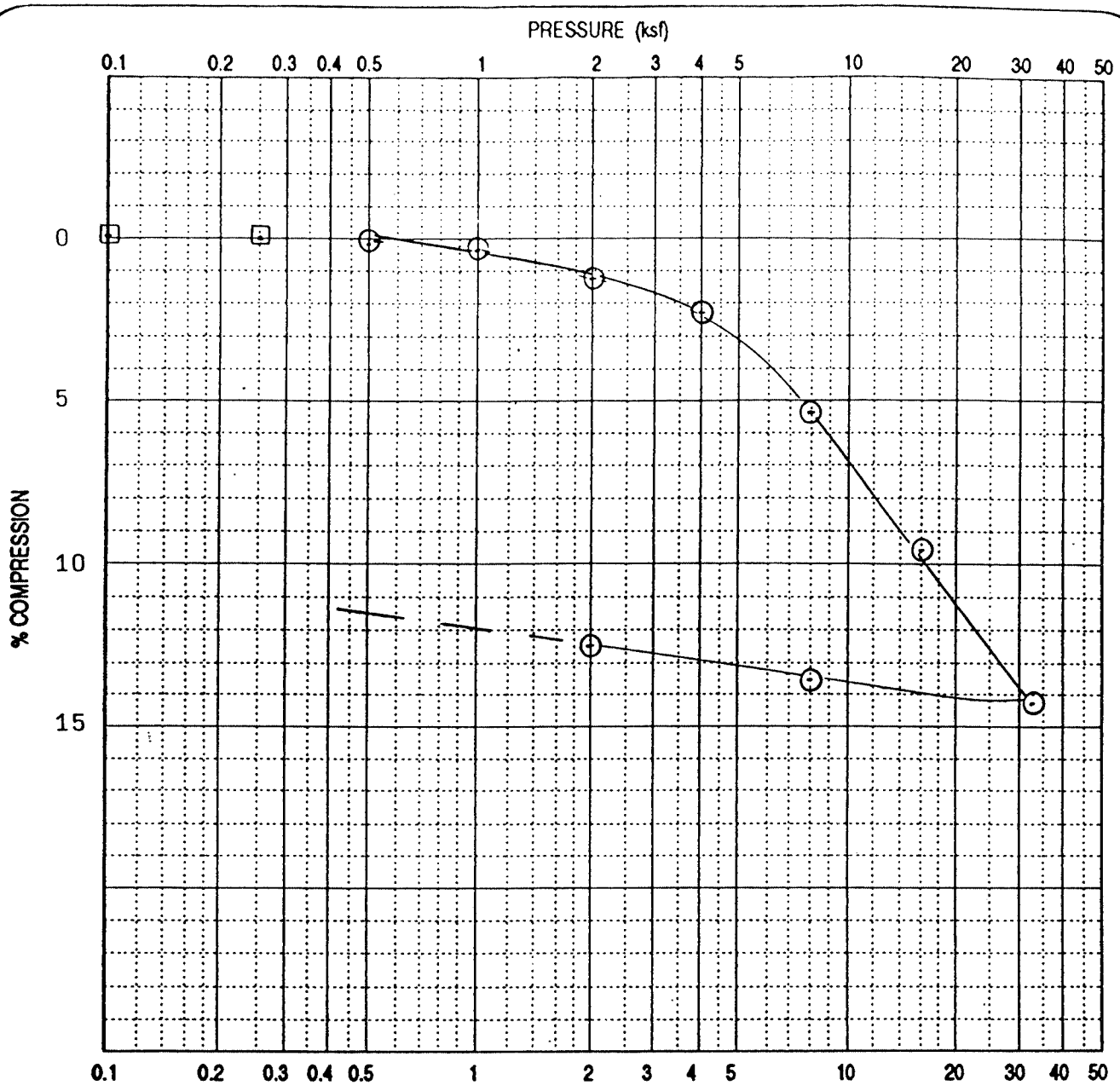
SAMPLE DATA	TEST NUMBER 1	2	3
Symbol	◇	□	○
Boring	B11	B11	
Depth ft. /Sample No.	27.5	28	
Initial			
Water Content, %	31.0%	24.0%	
Dry Density, pcf	91.1	100.9	
Saturation, %	99.9%	100%	
Void Ratio	0.828	0.633	
Initial Area, cm^2	42.10	41.91	
Initial Height, cm	15.2	15.2	
At Test (Post Consolidation)			
Final Water Content, %	30.2%	23.0%	
Dry Density, pcf	92.1	102.4	
Saturation, %	99.9%	99.8%	
Void Ratio	0.809	0.608	
Consol. Pressure, kips/sq.ft..	0.72	1.44	
Major Principal Stress, ksf	2.12	3.48	
Minor Principal Stress, ksf	0.72	1.44	
Excess Pore Pressure, ksf	0.35	0.75	
Strain. %	4.2	3.0	

Type Test: TX/CU,
with pore pressure measurements
Method of Saturation: Back Pressure
Rate of Strain: 0.03 %/min
Remarks

Classification: ◇ **Boring 11, 27.5 feet**
□ **Boring 11, 28 feet**
○

HTA Harlan Tait Associate *Consulting Engineers and Geologists*	TRIAXIAL COMPRESSION TEST San Thomas Aquino Creek Levee Santa Clara Valley Water District	***FIGURE*** **B-19**
Proj. No 1276.010 *Date:* 1/17/98 *App'd by:*		

F:\HOME\TOB\SCVWD Lab Testing\[1330.01 TXCU San Thomas B11.xls]Figure 4/9/98 14:25



▣ prevent swelling

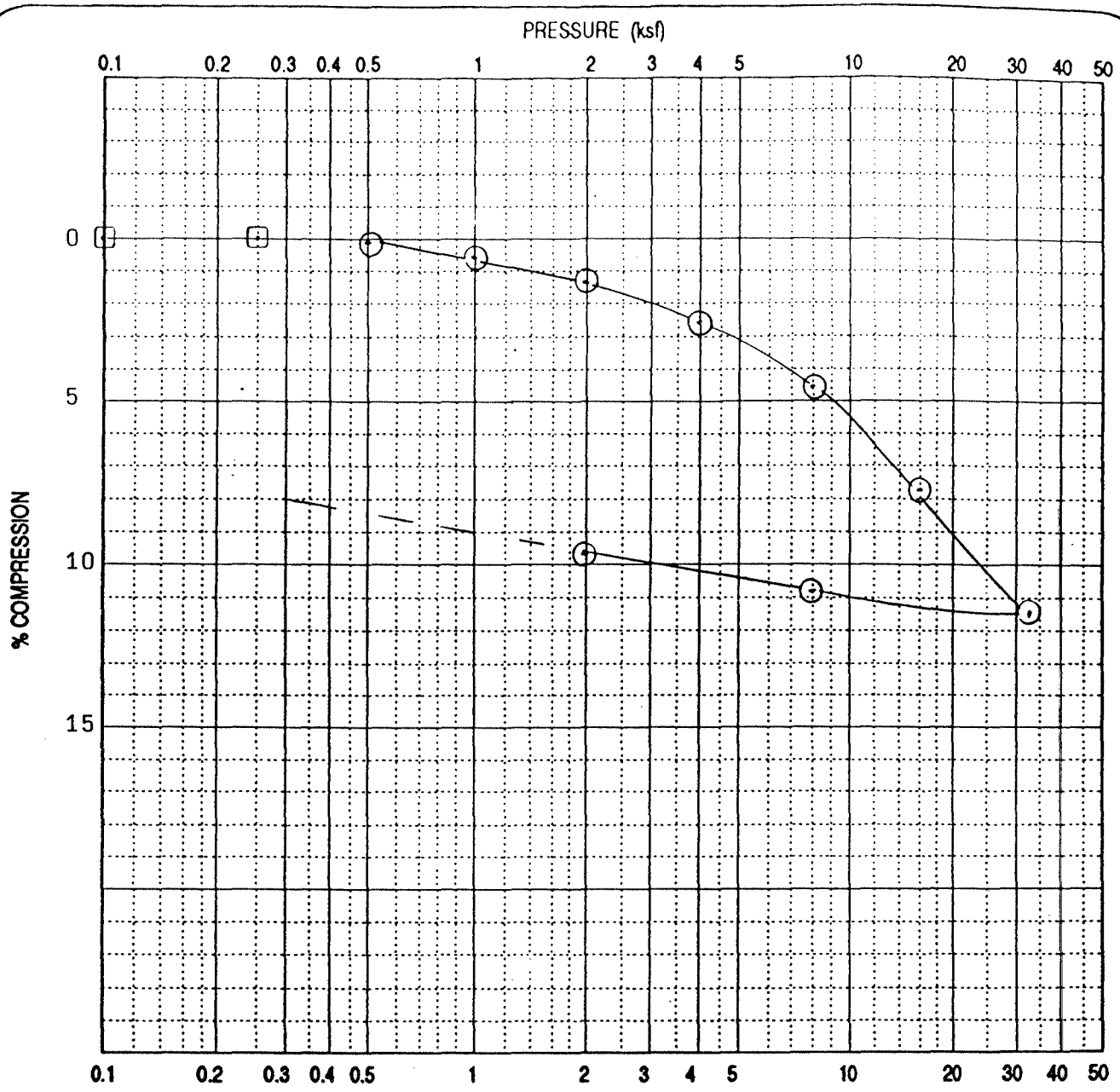
Type of Specimen		BEFORE TEST	AFTER TEST
Diameter (inches) 2.42	Height (inches) 1.000	Moisture Content, w_o (%) 29.5	Moisture Content, w_f (%) 22.3
Overburden Pressure, P_o (ksf)		Void Ratio, e_o 0.846	Void Ratio, e_f 0.615
Preconsol. Pressure, P_c (ksf)		Saturation, s_o (%) 96	Saturation, s_f (%) 100
Compression Index, C_c		Dry density, γ_d (pcf) 93.3	Dry density, γ_d (pcf) 106.7
LL	PL	PI	G_s est. 2.76
Classification Mottled GrayRust Silty Clay		Source B1 at 18.7 ft.	

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CONSOLIDATION TEST REPORT

Proj. No. 1330.01 Date: 3/31/98 App'd. by:

FIGURE B-20



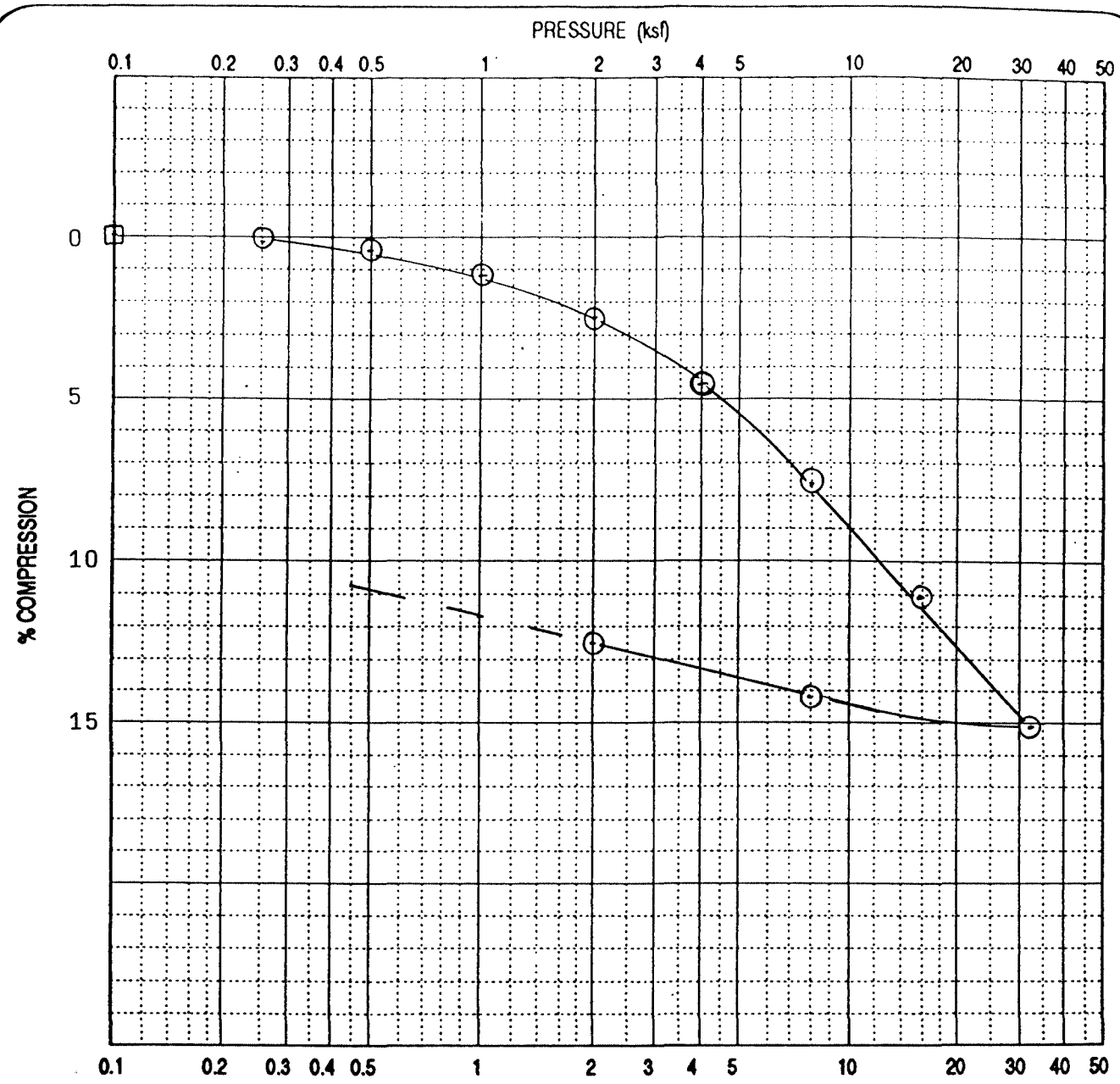
Type of Specimen		BEFORE TEST	AFTER TEST
Diameter (inches) 2.42	Height (inches) 1.000	Moisture Content, w_o (%) 26.4	Moisture Content, w_f (%) 21.0
Overburden Pressure, P_o (ksf)		Void Ratio, e_o 0.747	Void Ratio, e_f 0.577
Preconsol. Pressure, P_c (ksf)		Saturation, s_o (%) 97	Saturation, s_f (%) 100
Compression Index, C_c		Dry density, γ_d (pcf) 97.0	Dry density, γ_d (pcf) 108.4
LL	PL	PI	G_s est. 2.74
Classification Mottled Gray Brown Silty Cla		Source B3 at 15.9 ft.	

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Proj. No. 1330.01 *Date:* 3/31/98 *App'd. by:*

FIGURE B-21



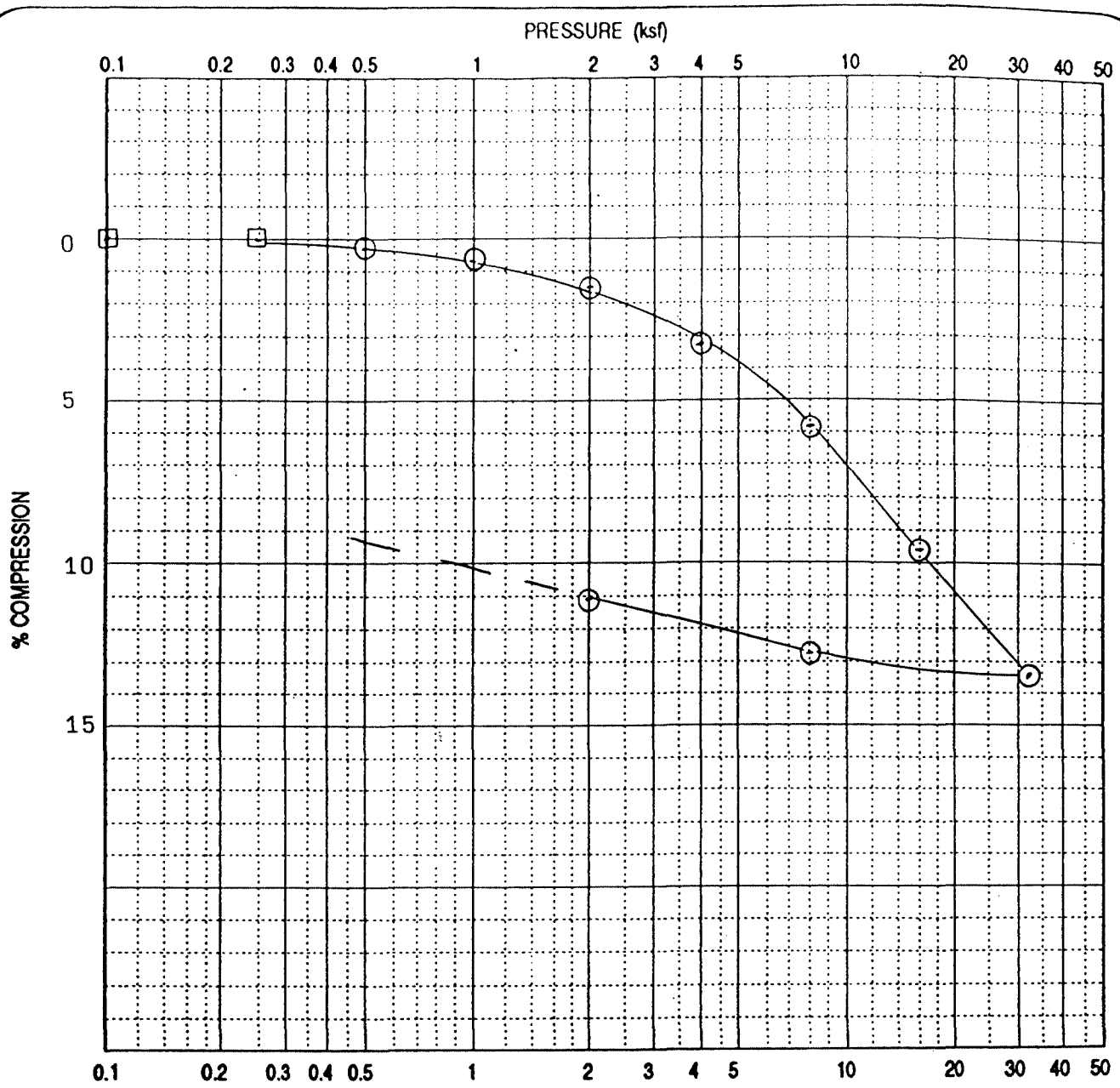
Type of Specimen			BEFORE TEST	AFTER TEST	
Diameter (inches) 2.42	Height (inches) 1.000		Moisture Content, w_o (%) 31.1	Moisture Content, w_f (%) 23.2	
Overburden Pressure, P_o (ksf)			Void Ratio, e_o 0.879	Void Ratio, e_f 0.642	
Preconsol. Pressure, P_c (ksf)			Saturation, s_o (%) 98	Saturation, s_f (%) 100	
Compression Index, C_c			Dry density, γ_d (pcf) 92.0	Dry density, γ_d (pcf) 105.3	
LL	PL	PI		G_s est. 2.77	
Classification Mottled GrayRustSilty Clay		Source B11 at 27 ft.			

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CONSOLIDATION TEST REPORT

FIGURE B-22

Proj. No. 1330.01 Date: 3/31/98 App'd. by:



Type of Specimen		BEFORE TEST	AFTER TEST
Diameter (inches) 2.42	Height (inches) 1.000	Moisture Content, w_o (%) 27.1	Moisture Content, w_f (%) 21.4
Overburden Pressure, P_o (ksf)		Void Ratio, e_o 0.765	Void Ratio, e_f 0.570
Preconsol. Pressure, P_c (ksf)		Saturation, s_o (%) 94.6	Saturation, s_f (%) 100
Compression Index, C_c		Dry density, γ_d (pcf) 97.0	Dry density, γ_d (pcf) 106.1
LL	PL	PI	G_s est.2.67
Classification Gray Silty Clay		Source B9 at 22ft.	

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CONSOLIDATION TEST REPORT

Proj. No. 1330.01 Date: 3/31/98 App'd. by:

FIGURE
B-23

Boring	Depth feet	Permeability cm/sec
B-7	12.5	$1x10^{-8}$
B-9	6.5	$8x10^{-8}$
B-9	20.8	$5x10^{-7}$

KLEINFELDER

PROJECT NO. 12-3039-40

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara California

PERMEABILITY TEST RESULTS

PLATE

B-24

Boring	Depth feet	Confining Pressure psf	Deviator Stress psf	Strain at Maximum Deviator Stress percent
B-2	13	500	4950	5.7
B-2	18.5	0	2190	5.5
B-2	25.5	0	1690	5.6
B-3	5.5	0	8900	12.3
B-3	26	750	1540	10.3
B-4	9	550	3080	10.2
B-7	8.5	480	2130	8.5
B-7	13.5	810	1580	8.5
B-8	8.5	500	2400	12.3
B-8	11	660	4080	10.5
B-8	16	0	4890	15.2
B-9	3.5	220	2000	10.2
B-9	8.5	475	2130	9.2

KLEINFELDER

PROJECT NO. 12-3039-40

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

STRENGTH TEST RESULTS

PLATE

B-25

Boring Number	Depth Feet	Material Description	Maximum Dry Density pcf	Optimum Moisture Content, percent
B-3	0-10	Sandy Clay, trace gravel (CL)	124.5	11.5
B-7	0-10	Clayey sand, trace gravel (SC)	129.0	10.4
B-8	0-10	Clayey Sand, trace gravel (SC)	127.0	11.0
B-9	0-10	Clayey Sand, little gravel (SC)	127.5	11.0
B-10	0-10	Sandy Clay, trace gravel (CL)	120.0	13.5

KLEINFELDER

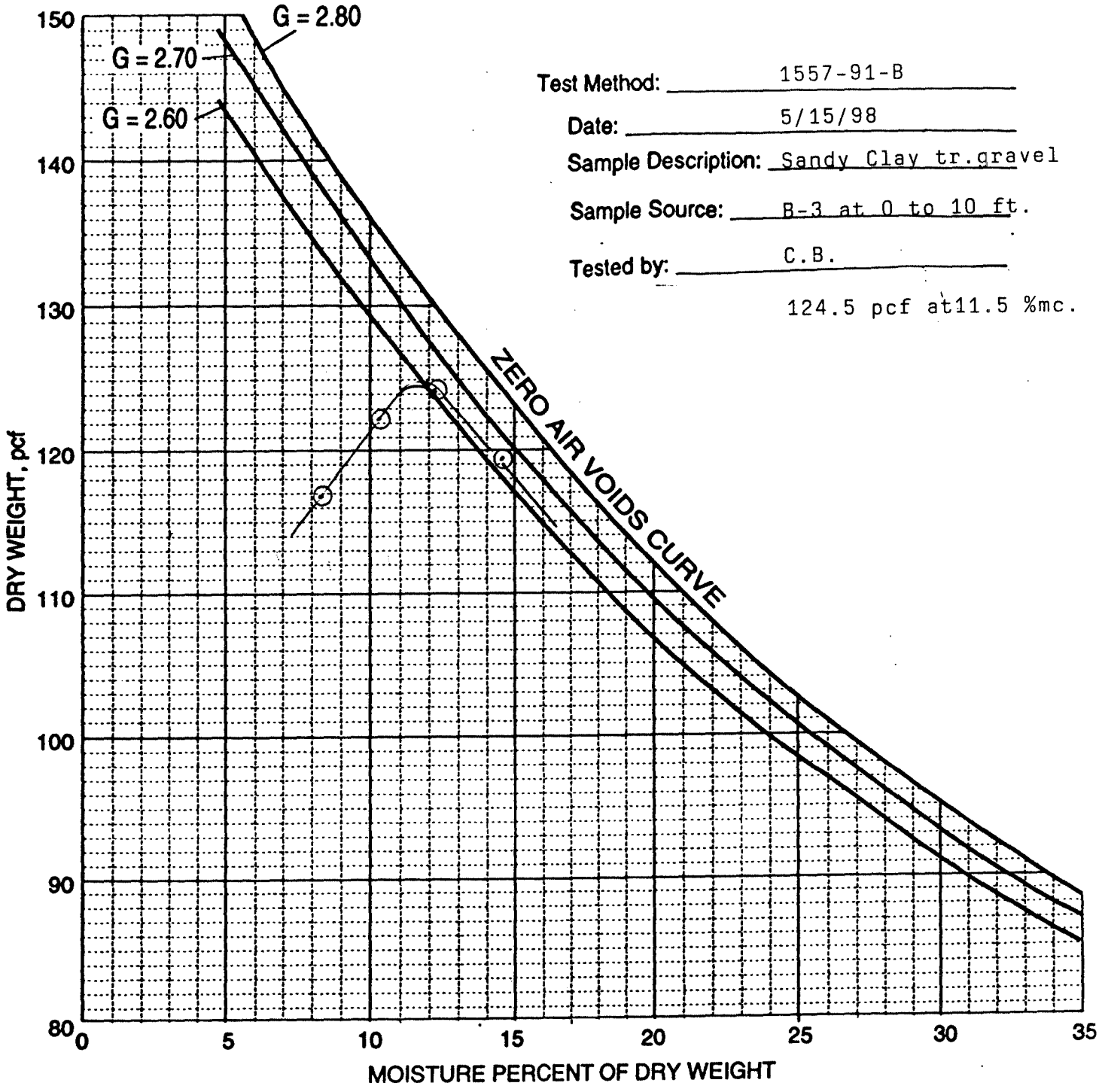
PROJECT NO. 12-3039-40

San Tomas Aquino Creek Levees
Santa Clara Valley Water District
Santa Clara, California

LABORATORY COMPACTION TESTS

PLATE

B-26



Test Method: 1557-91-B

Date: 5/15/98

Sample Description: Sandy Clay tr.gravel

Sample Source: B-3 at 0 to 10 ft.

Tested by: C.B.

124.5 pcf at 11.5 %mc.

Compaction

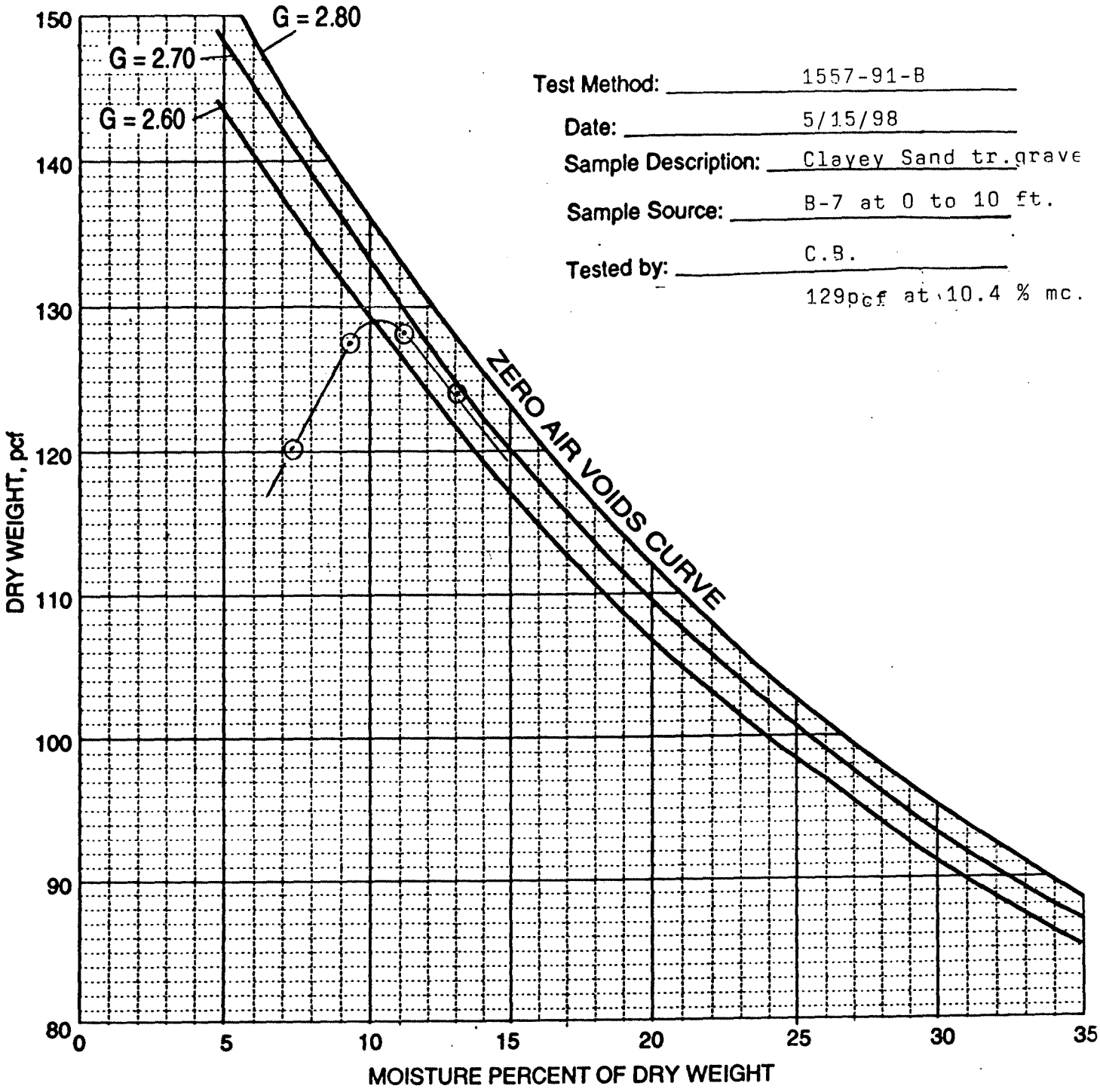
Project Name: San Tomas

Project Number: 1330 .01

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Test Method: 1557-91-B

Date: 5/15/98

Sample Description: Clayey Sand tr.grave

Sample Source: B-7 at 0 to 10 ft.

Tested by: C.B.

129pcf at 10.4 % mc.

Compaction

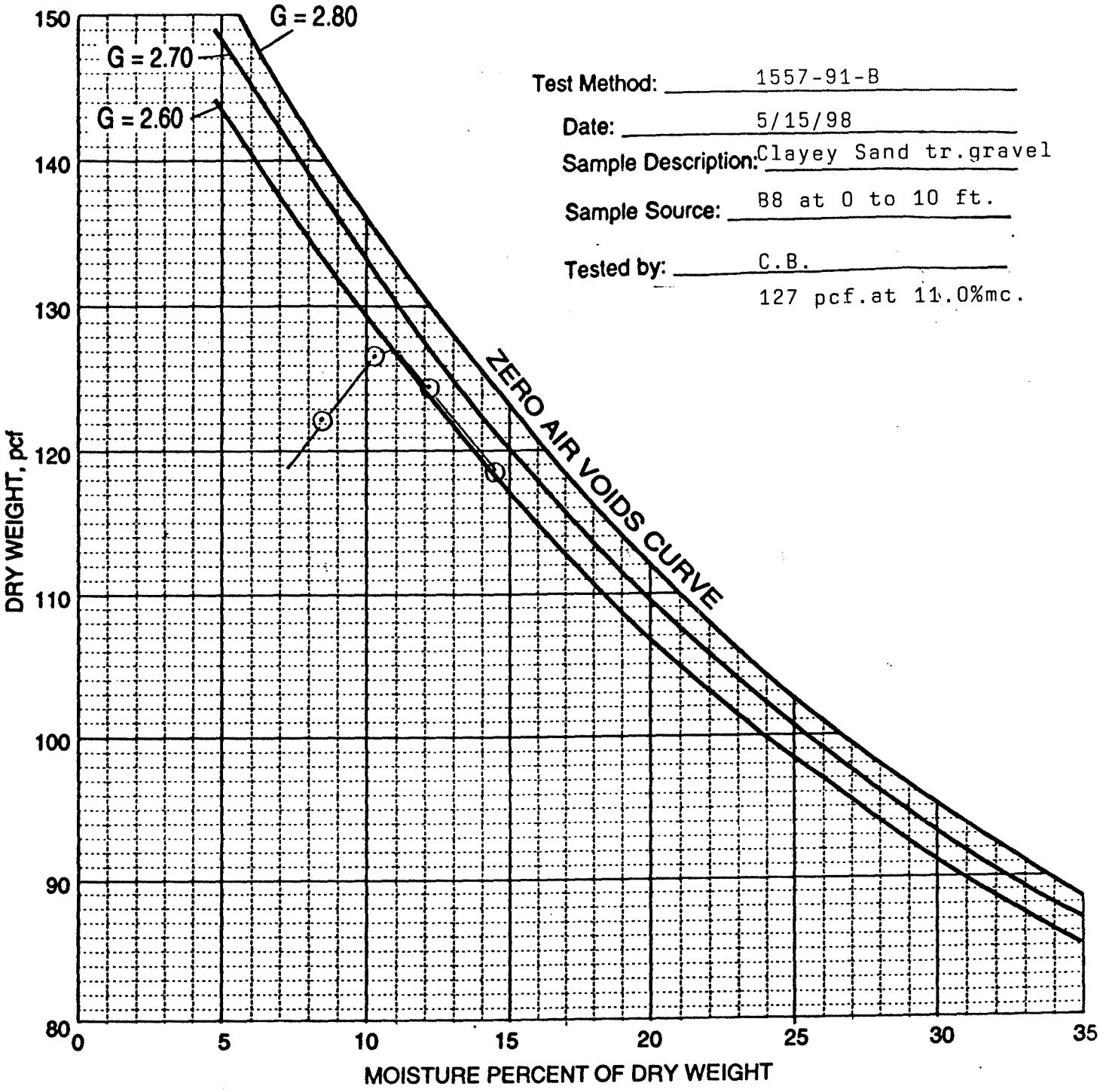
Project Name: San Tomas

Project Number: 1330.01

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Test Method: 1557-91-B

Date: 5/15/98

Sample Description: Clayey Sand tr.gravel

Sample Source: B8 at 0 to 10 ft.

Tested by: C.B.

127 pcf.at 11.0%mc.

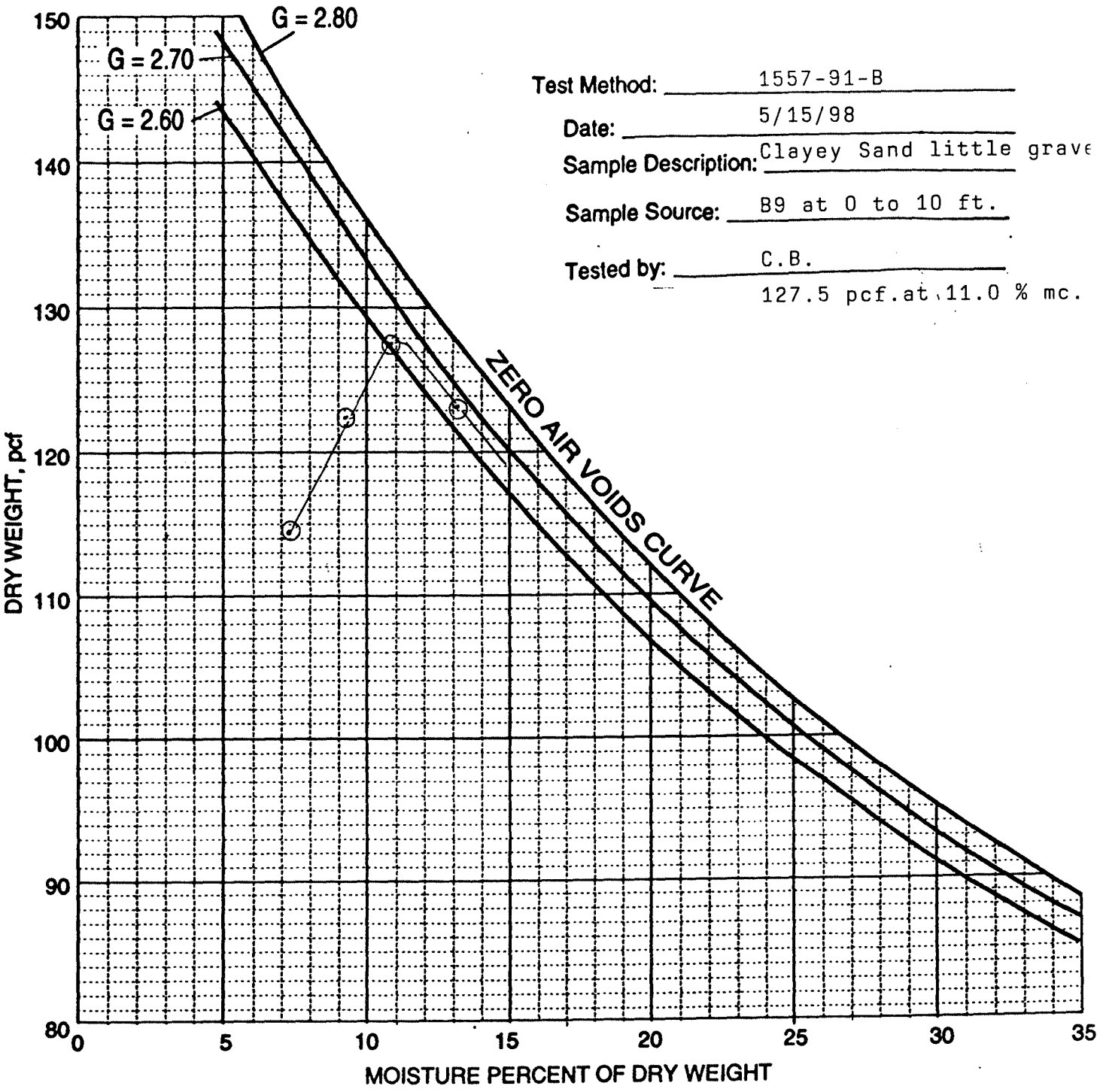
Compaction

Project Name: San Tomas

Project Number: 1330.01

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Test Method: 1557-91-B

Date: 5/15/98

Sample Description: Clayey Sand little grave

Sample Source: B9 at 0 to 10 ft.

Tested by: C.B.

127.5 pcf.at 11.0 % mc.

Compaction

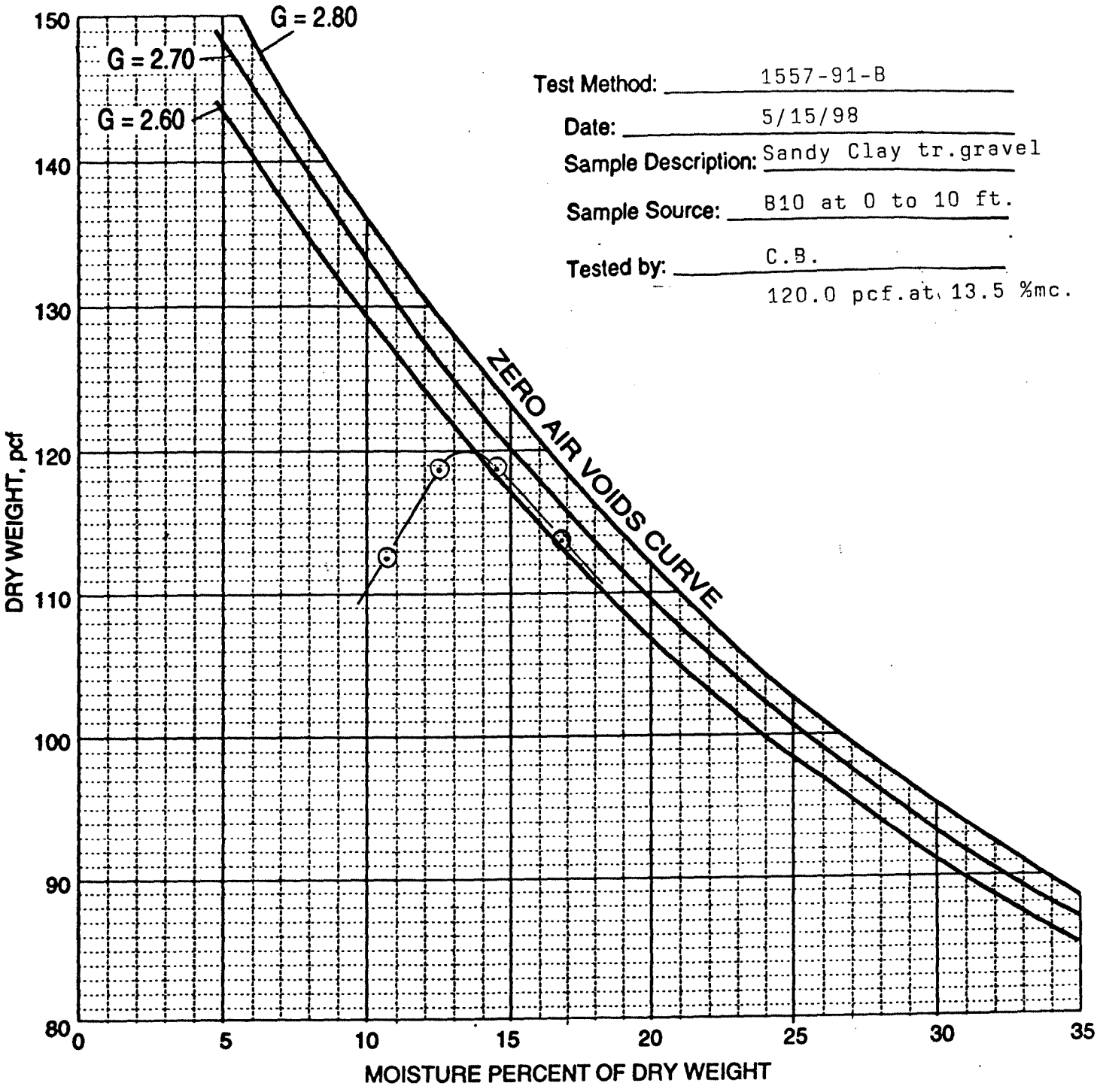
Project Name: San Tomas

Project Number: 1330.01

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Test Method: 1557-91-B

Date: 5/15/98

Sample Description: Sandy Clay tr.gravel

Sample Source: B10 at 0 to 10 ft.

Tested by: C.B.

120.0 pcf.at 13.5 %mc.

Compaction

Project Name: San Tomas

Project Number: 1330.01

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Appendix C

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY p.c.f.	IN-PLACE MOISTURE CONTENT % dry wt.
0				Ground Surface at 27.0 ft.		
	1-1		12	Silty SAND w/traces of gravel, tan, med. dense, moist (SM)	115.9	10.7
				Silty SAND w/slight clay binder & gravel, brown, moist (SM)		
5	1-2		9	Silty CLAY, black, stiff, wet (CL/CH)	88.3	27.9
10	1-3		15	Sandy CLAY w/gravel, mottled grey/tan, stiff, moist (CL)	105.3 115.2	20.8 15.9
				▼ 1030; 31 Aug. '77		
15	1-4		10	Mixed Silty CLAY - Sandy CLAY, mottled brown/grey, stiff, wet (CL)	103.3	22.0
20	1-5		9	Fine Silty SAND, brown, loose, saturated (SM)	-	-
				Fine SAND-GRAVEL mixture, brown, loose, saturated (GW)		
25	1-6		9	CLAY-GRAVEL-SAND mixture, mottled brown/ grey/ medium stiff, loose (GC)	-	-
30						

Figure 3 - Log of Test Boring No. 1

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf.	IN-PLACE MOISTURE CONTENT % dry wt
				Boring #1 Con't.		
30	1-7		16	Silty CLAY w/fine sand, grey/tan, very stiff, wet (CL)	105.7	22.6
35	1-8		12	Mixed Silty CLAY - Sandy CLAY, wet (CL)	105.4	20.8
				Mixed fine Sandy CLAY-Clayey SAND, moist		
40	1-9		10	Clayey fine SAND w/rust flecking, grey, medium dense, wet (SC)	111.1 101.6	18.2 23.0
45	1-10		18	Silty CLAY w/traces of sand, mottled grey/light grey, very stiff, wet (CL)	105.3 102.4	21.9 22.1
				Coarse SAND-GRAVEL mixture, grey, loose, wet (GW)		
50	1-11		18	Clayey SAND & GRAVEL w/Silty CLAY lenses, grey, med. dense, moist (GC)	117.3	14.3
				Boring Terminated at 51.0 ft. Groundwater Encountered at 14.0 ft. Date Drilled: 30 & 31 Aug. 1977		

Figure 3 - Log of Test Boring No.1 (cont.)

File: 1/77087/1
30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf	IN-PLACE MOISTURE CONTENT % dry wt
				Ground Surface at 24.0 ft.		
0				Roadbase		
	2-1		10/6"	Sandy SILT w/gravel, brown, very stiff, damp (SM)	109.2	10.0
			15/6"	Sandy SILT w/organics, dark brown, very stiff, moist (SM)	112.9	15.5
5	2-2		6/6"	Silty CLAY, mottled tan-brown w/black, stiff (CL)	96.3	24.9
			10/6"	Silty CLAY, black, very stiff, wet (CL)		
				Silty CLAY, black (CL)		
10	2-3		9/6"	Mixed Sandy CLAY-Silty CLAY, tan/brown, very stiff, moist (CL)	110.7	17.3
			13/6"	Fine to med. Silty SAND, tan/brown, medium dense, moist (SM)	103.6	13.4
15	2-4		7	Mixed Sandy CLAY-Clayey SAND w/organics, w/occasional sm. gravels, mottled tan/brown, med. stiff, moist (CL-SC)	102.3	23.6
				increasing clay content	99.6	25.2
20	2-5		2/6"	▼ 1 Sept., '77 Silty CLAY w/traces of sand, soft, wet (CL)	88.4	33.8
			3/6"	Silty CLAY w/organics and traces of very fine sand, dark bluish-grey, medium stiff, wet (CL)	88.5	33.4
25	2-6		5	Very fine Sandy CLAY w/organics, medium stiff, wet (CL)	98.9	25.7
				very fine Sandy SILT w/clay binder, & organics, med. stiff, wet (SM)	102.4	24.1
30				Boring Terminated at 26.0 ft. Groundwater Encountered at 20.0 ft. Date Drilled: 1 Sept. 1977		

Figure 4 - Log of Test Boring No. 2

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY p.c.f.	IN-PLACE MOISTURE CONTENT % dry wt
0				Ground Surface at 23.5 ft.		
				Roadbase		
	3-1		10	Silty SAND w/sm. occasional gravel, brown, medium dense, moist (SM)	109.3	13.4
					104.3	12.2
5	3-2		3/6"	(at 5', grading with clay binder)	95.9	18.2
			5/6"	Silty CLAY w/med. silty sand, organic material, black, stiff, wet (CL)	89.2	24.6
10	3-3		11	Silty CLAY w/trace of sand, mottled tan-brown/grey, stiff, moist (CL)	108.7	19.9
15	3-4			▼ 1015; 2 Sept. '77		
			10	Silty CLAY w/occasional gravel and organics, grey, stiff, wet (CL)	94.5	26.4
					95.4	24.6
				Silty CLAY w/trace of sand-gravel, grey/brown (CL)		
				Silty GRAVEL, grey, wet (GM)		
20	3-5		7	Very fine Sandy SILT, brown/grey, med. stiff, wet (SM)	97.9	25.6
				Very fine Sandy SILT, grey, medium stiff (SM)		
25	3-6			Silty CLAY w/traces of fine sand, mottled grey/brown, stiff, wet (CL)		
			14		99.3	25.9
					100.2	23.4
				Boring Terminated at 26.0 ft. Groundwater Encountered at 15.0 ft. Date Drilled: 2 Sept. '77		

Figure 5 - Log of Test Boring No. 3

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY p.c.f.	IN-PLACE MOISTURE CONTENT % dry wt.
0				Ground Surface at 19.5 ft.		
				Roadbase		
				Fine Silty SAND, reddish brown, loose, damp (SM)		
	4-1		5/6"		103.7	9.1
			6/6"	Clayey SILT w/fine to coarse sand and gravel, rust flecking, mottles tan/brown,	106.0	15.2
5	4-2		6/6"	stiff, moist (ML)		
			7/6"	Silty CLAY w/trace of sand and gravel, roots, black/brown, stiff, wet (CL)	94.3	22.9
				Sandy CLAY w/clayey sand lenses and organics, wet (CL)		
10	4-3		6	(at 10' becoming mottled tan/brown)		
	4-4		4		98.6 98.4	24.3 24.0
15	4-5		5	▼ 1300; 2 Sept. '77	-	27.2
20	4-6		4	Silty CLAY w/sand, bluish-grey, soft, wet (CL)	97.8	29.2
25	4-7		17	Silty CLAY w/sand, grey-brown, very stiff, wet (CL)	105.9 108.7	21.6 19.9
30				Boring Terminated at 26.0 ft. Groundwater Encountered at 15.0 ft. Date Drilled: 2 Sept. 1977		

Figure 6 - Log of Test Boring No. 4

File: 1/77087/1

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf.	IN-PLACE MOISTURE CONTENT % dry wt.
				Ground Surface at 17.0 ft.		
0				Roadbase		
				Mixed Silty CLAY-Clayey SILT, reddish brown, moist (CL/ML)		
	5-1		9	Fine Sandy SILT, mottled red/brown, stiff, moist (SM)	109.4 91.1	14.3 17.4
5	5-2		4	Sandy CLAY w/heavy organics, rust flecking mottled grey, soft to medium stiff, wet (CL)	90.0	27.4
				Sandy GRAVEL w/binder, black/brown, wet (GP)		
10	5-3		7	Silty CLAY w/trace of sand & organics, bluish grey, med. stiff, wet (CL)	90.7	31.8
				Silty CLAY w/trace of gravel, brown/tan medium stiff, wet (CL)	104.2 105.7	21.3 21.3
				▼ 1530; 2 Sept. '77		
15	5-4		7	Silty CLAY w/organics, rust flecking, med. stiff, wet (CL)	91.2	32.3
20	5-5		8	Mixed fine to med. SAND w/binder-Silty CLAY, grey/brown, med. stiff to stiff, wet (SW-CL)	104.3 93.7	25.3 28.7
25	5-6		17	Silty CLAY w/occ. gravel, tan/brown, very stiff, moist (CL)	109.7	20.0
				Boring Terminated at 26.0 ft. Groundwater Encountered at 12.5 ft. Date Drilled: 2 Sept. 1977		
30						

Figure 7 - Log of Test Boring No. 5

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY p.c.f.	IN-PLACE MOISTURE CONTENT % dry wt
0				Ground Surface at 16.5 ft.		
				Roadbase		
				Sandy SILT w/gravel, brown, moist (SM)		
	6-1		6/6"	Sandy SILT, brown, stiff, moist (SM)	104.6	16.4
			8/6"	Sandy SILT w/gravel, brown, very stiff, moist (SM)	105.5	13.6
5			5/6"	Silty CLAY w/organics, black/brown, stiff,	96.7	24.5
	6-2		8/6"	wet (CL)	98.1	24.4
				Silty CLAY w/organics, brown, stiff, wet (CL)		
10	6-3		8	(at 10', mottled tan/brown, medium stiff)	-	-
			3/6"			
	6-4		4/6"	Silty CLAY w/Sandy CLAY lenses, mottled brown/tan /orange, medium stiff, wet	93.7	22.4
				▼ 1010; 6 Sept. '77 (CL)		
15	6-5		4	Mixed Silty CLAY-Clayey SILT, soft, wet (CL-ML)	91.5	31.0
20	6-6		6	Silty CLAY, brown/grey, medium stiff, wet (CL)	97.3	28.4
25	6-7		12		111.5	19.3
				Boring Terminated at 26.0 ft. Groundwater Encountered at 13.5 ft. Date Drilled: 6 Sept. 1977		
30						

Figure 8 - Log of Test Boring No. 6

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf	IN-PLACE MOISTURE CONTENT % dry wt
0				Ground Surface at 17.0 ft.		
				Roadbase		
				Silty SAND w/gravel, brown (SM)		
	7-1		13	Sandy SILT mixed with Silty CLAY, brown, stiff, moist (SM)	108.5	15.5
5	7-2		11	Silty CLAY with sand & gravel, mottled brown, stiff, moist (CL)	111.1	18.8
10	7-3		11	Silty CLAY, traces of sand, and gravel lenses, dark brown, stiff, wet (CL)	97.6 103.1	24.7 21.0
				becoming mottled brown		
15	7-4		6	drilling stiffer	-	-
				▼ 1550; 31 Aug. '77		
20	7-5		9	SAND-CLAY mixture, stiff, wet (SC)	121.6	20.7
				Medium SAND with slight clay binder, med. dense, wet (SP)		
25	7-6		11		-	25.9
				increasing clay content (SP)		
30						

Figure 9 - Log of Test Boring No. 7

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY p.c.f.	IN-PLACE MOISTURE CONTENT % dry wt.
				Boring #7 con't		
30	7-7		11	medium SAND w/binder (SP) Silty CLAY w/sand, brown, stiff, moist (CL)	110.3	19.4
35	7-8		9	(at 35 feet, mottled tan/brown, stiff, wet)	93.4	29.1
40	7-9		13	(at 40 feet, traces of sand)	109.8	19.8
45	7-10		21	(at 45 feet, traces of gravel)	108.2	21.2
50	7-11		13	(at 50 feet, brown, traces of sand)	102.6 101.7	23.9 24.1
				Boring Terminated at 51.0 ft. Groundwater Encountered at 17.5 ft. Date Drilled: 31 Aug. 1977		

Figure 9 - Log of Test Boring No. 7 (cont)

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf	IN-PLACE MOISTURE CONTENT % dry wt
0				Ground Surface at 14.0 ft.		
				Roadbase		
	8-1		5	Sandy SILT w/gravel, reddish brown, med. stiff, moist (SM)	86.2 96.9	28.7 14.8
5	8-2		5	Silty CLAY w/occ. gravel, brown, medium stiff, moist (CL)	92.5	14.6
				Mixed Silty CLAY-Clayey SILT, black/ brown, medium stiff, moist (CL-ML)		
10	8-3		15	Silty CLAY/trace sand, grey/tan-brown, stiff, moist (CL)	111.0	18.3
				CLAY-GRAVEL mixture, grey/tan, wet 1230; 6 Sept. '77 (GC)		
15	8-4		9	Silty SAND, tan/brown, loose, moist (SM)	-	16.8
				GRAVEL w/binder, tan/brown, wet (GM)		
20	8-5				-	-
				Sandy CLAY		
				decreasing sand content (CL)		
25	8-6		12	Fine Sandy CLAY, tan/brown/orange, stiff, moist (CL)	114.7	17.3
				Boring Terminated at 26.0 ft. Groundwater Encountered at 13.75 ft. Date Drilled: 6 Sept. 1977		
30						

Figure 10 - Log of Test Boring No. 8

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf	IN-PLACE MOISTURE CONTENT % dry wt
0				Ground Surface at 10.0 ft.		
				Roadbase		
				Clayey SILT w/occ. gravel, brown, moist (SM)		
	9-1		8/6"	Silty CLAY w/coarse sand & gravel, brown, stiff, moist (CL)	112.8	15.5
			9/6"		114.0	16.2
				Silty CLAY w/coarse sand & gravel, blue-grey, very stiff, moist (CL)		
5	9-2		5/6"	Silty CLAY w/heavy organics, dk. grey, stiff, wet (CL)	88.0	32.3
			7/6"	Silty CLAY w/heavy organics & occ. gravel, black/grey, stiff, wet (CL)	95.1	26.6
10	9-3		7/6"	Silty CLAY, grey/brown, stiff, wet (CL)	98.9	25.0
			10/6"	Silty CLAY w/trace sand, mottled tan/brown, very stiff, wet (CL)	105.6	21.6
				▼ 1000; 1 Sept. '77		
				encountered sand lense		
15	9-4		7	increasing sand content	-	27.3
				increasing moisture		
20	9-5		5	Silty CLAY w/heavy organics, mottled grey/tan, medium stiff, wet (CL)	88.1	32.7
					89.4	34.3
25	9-6		16	Fine Sandy CLAY, tan/brown, very stiff, moist (CL)	111.7	19.1
				Silty CLAY w/fine sand, mottled grey/brown, stiff, wet (CL)		
30						

Figure 11 - Log of Test Boring No. 9

File: 1/77087/1
30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf	IN-PLACE MOISTURE CONTENT % dry wt
				Boring #9, con't.		
30	9-7		10	Silty CLAY w/fine SAND, stiff, wet (CL)	104.3	22.5
35	9-8		23	(at 35', very stiff)	107.1	22.1
40	9-9		25	Silty CLAY, tan/brown, very stiff, moist (CL)	111.3	19.3
45	9-10		7	Clayey SAND, brown, loose, wet (SC)	111.1	21.2
50	9-11		15	Sandy SILT, brown, stiff, moist (SM)	115.4	16.9
				Boring Terminated at 51.0 ft. Groundwater Encountered at 13.0 ft. Date Drilled: 1 Sept. 1977		

Figure 11- Log of Test Boring No. 9 (cont)

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf	IN-PLACE MOISTURE CONTENT % dry wt
				Ground Surface at 10.0 ft.		
0				Roadbase		
				Sandy SILT w/gravel, brown, damp (SM)		
	10-1		13	Clayey SAND w/silty clay lenses, grey/ brown, stiff, moist (SC/CL)	99.5	18.5
5	10-2		9	Mixed Clayey SAND-Silty CLAY, brown/orange, stiff, moist (SC-CL)	100.5	11.0
				Silty CLAY, w/traces of very fine sand, dark brownish grey, soft to medium stiff, moist (CL)		
10	10-3		4		-	-
				▼ 1530; 6 Sept. '77		
15	10-4		6	Silty CLAY w/trace of sand, mottled grey/ brown, medium stiff (CL)	-	-
20	10-5		5	(at 20.5' grading to orange/brown)	-	-
25	10-6		15	Silty CLAY w/trace of sand, tan/brown/ grey, stiff, moist (CL)	113.8	17.8
				Boring Terminated at 26.0 ft. Groundwater Encountered at 13.5 ft. Date Drilled: 6 Sept. 1977		
30						

Figure 13 - Log of Test Boring No. 19.

File: 1/77087/1

30th November, 1977

DEPTH IN FEET	SAMPLE NO.	LOG & LOCATION OF SAMPLE	Penetration Resistance Blows/ft	DESCRIPTION	IN-PLACE DRY DENSITY pcf	IN-PLACE MOISTURE CONTENT % dry wt.
0				Ground Surface at 9.5 ft.		
				Roadbase		
				Sandy SILT w/gravel, brown, moist (SM)		
			4/6"	Silty CLAY w/trace sand, organics, medium	100.0	23.8
	11-1		6/6"	stiff (CL)		
				Silty CLAY, mottled tan/brown, stiff, wet (CL)		
5	11-2		7	Silty CLAY, grey/black, medium stiff, wet (CL)	99.7	22.5
10	11-3		5		96.0	24.0
				▼ 1010; 7 Sept. '77		
15	11-4		9		98.5	24.2
				Silty CLAY, mottled grey/tan/brown, stiff, wet (CL)	106.1	22.9
				Clayey SAND w/clay nodules & organics, mottled tan/brown, loose, wet (SC)		
20	11-5		4/6"		99.7	23.1
			5/6"	Mixed Clayey SAND/med. sand, grey/tan-brown, loose, wet (SC-SP)	102.5	22.3
				Silty SAND, grey/brown, loose, wet (SM)		
				Silty CLAY w/occ. gravel, grey, wet (CL)		
				GRAVEL-SILT-SAND mixture, grey, loose, wet (GM)		
25	11-6		5/6"	Silty CLAY, mottled tan/brown, stiff,		
			6/6"	moist (CL)	112.7	18.6
				Boring Terminated at 26.0 ft.		
				Groundwater Encountered at 13.5 ft.		
				Date Drilled: 7 Sept. 1977		
30						

Figure 13 - Log of Test Boring No. 11

Logged By: TN

Date Drilled: 3/15/78

EXPLORATORY BORING LOG

Hole No. B-9

Job No. 8-025-S1

Dry Density p.c.f.	Moisture Content %	Penet. Resist. Blows/ft.	Unconf. Comp. Strength, k.s.f.	Direct Shear Test "C" k.s.f.	Direct Shear Test "ø" Degree	Sample Number	Depth in Feet	Boring Log	DESCRIPTION
									Black silty CLAY - moist, stiff, grading to dark brown CL
99.2	25.4		6.2*			9-1	5		Mottled light gray and light brown silty CLAY, moist, stiff
							10		Medium brown mottled sandy CLAY CL
99.8	25.4					9-2			▼ ▽
							15		Gray-brown wet, dense sandy CLAY with gravel to 1½" CL
NO RECOVERY						9-3			Gray SILT grading to fine sand ML
							20		Gray slightly clayey fine-**
		36				9-4			Gray clean fine-medium SAND SC
									Gray clean fine-medium SAND, damp, dense SC
									Gray SILT, damp, very stiff MH
							25		Gray sandy CLAY with scattered gravel, wet, dense CL
97.6	25.5					9-5			Gray, brown, mottled silty CLAY moist, stiff CL
							30		Gray-blue clayey SAND & GRAVEL

Remarks: * field tested
** medium SAND SC

- Log of Test Boring

UNITED SOIL ENGINEERING, INC.

Logged By: TN

Date Drilled: 3/15/78

EXPLORATORY BORING LOG

Hole No. B-9 (2 of 2)

Job No. 8-025-S1

Dry Density p.c.f.	Moisture Content %	Penet. Resist. Blows/ft.	Unconf. Comp. Strength, k.s.f.	Direct Shear Test "C" k.s.f.	Direct Shear Test "ϕ" Degree	Sample Number	Depth in Feet	Boring Log	DESCRIPTION
NO RECOVERY						9-6	31		wet, dense SP
									Boring terminated @ 31
							35		

Remarks:

- Log of Test Boring

UNITED SOIL ENGINEERING, INC.

Logged By: TN

Date Drilled: 3/15/78

EXPLORATORY BORING LOG

Hole No. B-10

Job No. 8-025-S1

Dry Density p.c.f.	Moisture Content %	Penet. Resist. Blows/ft.	Unconf. Comp. Strength, k.s.f.	Direct Shear Test "C" k.s.f.	Direct Shear Test "ø" Degree	Sample Number	Depth in Feet	Boring Log	DESCRIPTION
									Dark gray, loose (to 1") to stiff sandy CLAY with scattered gravel CL
									Brown damp sandy CLAY with much silt- firm to stiff
							5		grades to
101.5	23.4					10-1			brown silty clay with caliche
									grades to sandy clay - damp, stiff
							10		
107.5	20.5					10-2			▽ brown grading to clayey sand- damp to wet, compact
			3.6*						
									back to
							15		
101.7	24.6					10-3			brown, gray mottled sandy clay
									Color changing to gray, sandy SILT, compacy, damp - grades to gray moist stiff clayey silt - grades to silty clay - moist, stiff ML
							20		
94.8	28.7					10-4			
									gray clayey sand and sandy clay - scattered gravel, wet, dense
							25		
							30		

Remarks: * field tested

- Log of Test Boring

UNITED SOIL ENGINEERING, INC.

Logged By: TN

Date Drilled: 3/15/78

EXPLORATORY BORING LOG

Hole No. B-10 (2 of 2)

Job No. 8-025-S1

Dry Density p.c.f.	Moisture Content %	Penet. Resist. Blows/ft.	Unconf. Comp. Strength, k.s.f.	Direct Shear Test "C" k.s.f.	Direct Shear Test "ø" Degree	Sample Number	Depth in Feet	Boring Log	DESCRIPTION
							35		Boring terminated @ 31'

Remarks:

- Log of Test Boring

UNITED SOIL ENGINEERING, INC.

APPLICATION FOR AUTHORIZATION TO USE

SAN TOMAS AQUINO CREEK LEVEES
SANTA CLARA, CALIFORNIA
Project No. 12-3039-40
January 20, 1999

Kleinfelder, Inc.
1362 Ridder Park Drive
San Jose, CA 95131
408-436-1155 408-436-1771
(telephone) *(fax)*

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To be Completed by Applicant

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(company name)

_____
(address)

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(city, state, zip)

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By: _____

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Date: _____

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